Tuntutuliak Water Treatment Plant/Washeteria

Preliminary Engineering Report

Tuntutuliak, Alaska

Owner:
Tuntutuliak Traditional Council
P.O. Box 8086
Tuntutuliak, Alaska 99680

Prepared for:
Village Safe Water
555 Cordova Street, 4th Floor
Anchorage, Alaska 99501

Prepared by:
Kuna Engineering.
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Anchorage, Alaska 99503

KUNA ENGINEERING

STATE OF ALASKA
49TH
DANIEL E. NICHOLS
CE 11012
7/24/2019
REGISTERED PROFESSIONAL ENGINEER

FINAL REPORT
May 23, 2019

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ABBREVIATIONS

ADEC.....Alaska Department of Environmental Conservation
ANTHC.....Alaska Native Tribal Health Consortium
BIA.....Bureau of Indian Affairs
CYD..... Cubic Yards
DCCED .....Department of Commerce, Community, and Economic Development
EA .....Each
EPA .....Environmental Protection Agency
FEMA.....Federal Emergency Management Agency
FONSI.....Finding of No Significant Impact
ft.....Feet
GAC ..... Granulated Active Carbon
GFCI .....Ground Fault Circuit Interrupter
gpcd..... Gallons per Capita-Day
gpd .....Gallons per Day
gpm ..... Gallons per Minute
HR.....Hours
HVAC .....Heating Ventilation Air Conditioning
In ..... Inch
kWh..... Kilo Watt Hour
lbs..... Pounds
LF..... Linear Feet
LS..... Lump Sum
MCL .....Maximum Contaminant Level
µg/L ..... micrograms per liter
n/a..... Not Applicable
No.....Number
O&M.....Operations and Maintenance
PER .....Preliminary Engineering Report
ppm ..... Parts Per Million
ROW ..... Right of Way
RUBA ..... Rural Utility Business Advisor
SHPO .....State Historical Preservation Office
SQFT .....Square Foot
T&E.....Threatened and Endangered
UBC..... Unified Building Code
USACE.....US Army Corps of Engineers
USDA-RUS.....US Department of Agriculture-Rural Utilities Service
USFWS.....US Fish and Wildlife Service
VOC ..... Volatile Organic Compounds
VSW..... Village Safe Water
WTP.....Water Treatment Plant
°F ..... Degrees Fahrenheit

1.0 PROJECT PLANNING

Village Safe Water (VSW) and Tuntutuliak Traditional Council contracted with Kuna Engineering in June 2018 to develop a Preliminary Engineering Report (PER) to bring the community water system into arsenic and lead compliance and improve access to sanitation facilities by replacing the water treatment plant (WTP) and washeteria. The project was funded by the US Department of Agriculture, Rural Utilities Service (USDA-RUS) and VSW. This PER was prepared using USDA-RUS Bulletin 1780-2.

The purpose of the PER is to provide an engineering assessment of the existing water situation, assess needs, evaluate improvement alternatives, select a preferred alternative, develop a project plan, and provide recommendations.

The PER was developed with the help from the following participants:

- Daniel Nichols, P.E. (Kuna Engineering, Project Manager)
- Susan Randlett (VSW, Project Manager)
- Deanna White (Native Village of Tuntutuliak, Tribal Administrator)
- Andrea Johnson (Native Village of Tuntutuliak, Tribal Secretary)
- Tom Carl (Native Village of Tuntutuliak, Maintenance Supervisor)
- Tom Friendly (Native Village of Tuntutuliak, WTP Operator)
- Alice Fitka (Tuntutuliak Native Council, Vice President)
- Peter Miely (Tuntutuliak Native Council, Council Member)
- Frank Lupie (Tuntutuliak Native Council, Council Member)
- John Fitka (Tuntutuliak Native Council, Secretary)

Many others assisted in the development and review of the PER. More information about community and public involvement can be found in Appendix B.

a. Location

Tuntutuliak is located on the Kinak River (Qinaq River), approximately five miles from its confluence with the Kuskokwim River. The community is about 40 miles from the Bering Sea and 40 miles southwest of Bethel, the regional hub.

Tuntutuliak is off the road system and is only accessible by water and air. The community is accessible from the Kuskokwim and Kinak Rivers. Barge service delivers goods and fuel approximately six times a year. Boats and snow machines are used for local travel. There is a state-maintained public airport with a 3,025-foot by 90-foot gravel runway and a public seaplane base on the Kinak River. There is daily air service to the community from Bethel and area villages. Winter trails are marked each year to Kipnuk and Kongiganak.

The Public Land Survey system description of Tuntutuliak is Sections 16, 17, 20, and 21; Township 030 N; Range 077 W of the Seward Meridian, Alaska. USGS quadrant map is Baird Inlet B-2.

The WTP/washeteria is located at 60° 20’ 24.21” N Latitude and 160° 40’ 6.95” W Longitude.

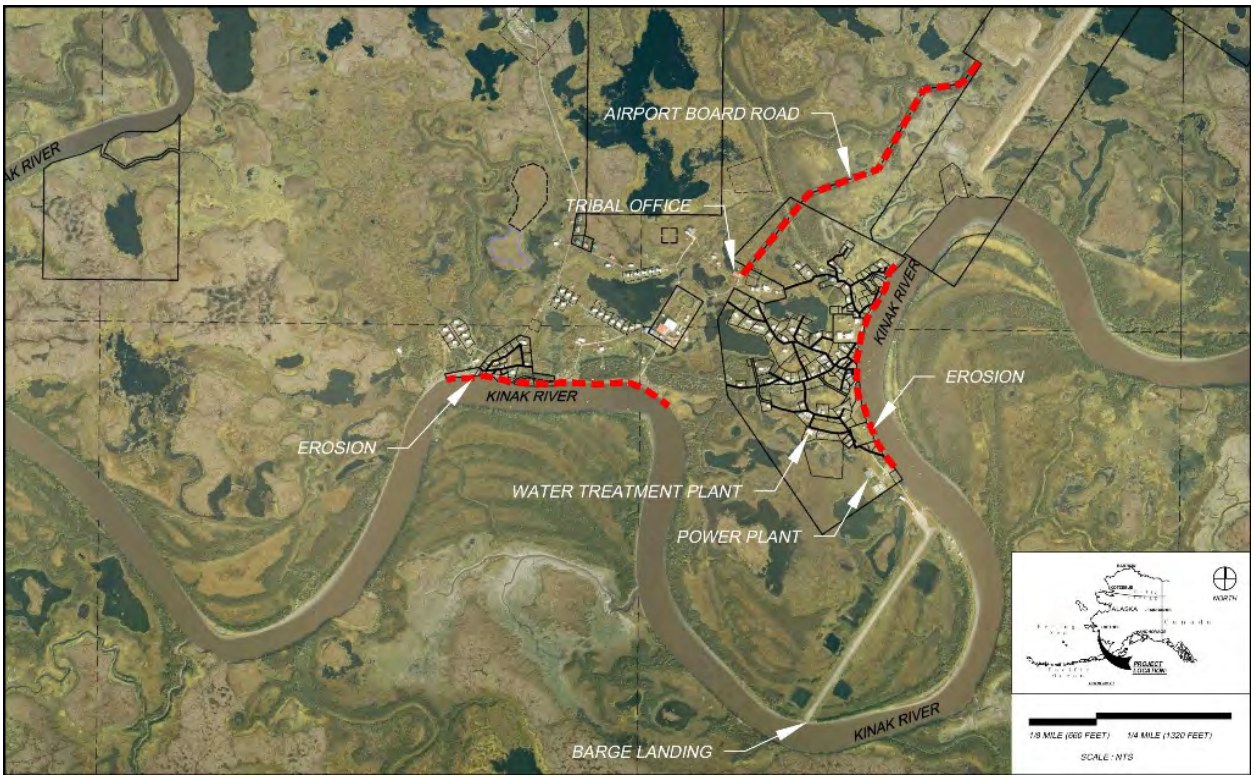


Figure 1.1: Community Map

b. Environmental Resources Present

i. Climate

Tuntutuliak falls within the western transitional climate zone, characterized by tundra interspersed with boreal forests, and weather patterns of long, cold winters and shorter, warm summers. The closest National Oceanic and Atmospheric Administration recording station is Bethel.

Table 1.1: Regional Climate Data

Annual	Values
Average Precipitation (in)	20.69
Average Rainfall (in)	18.58
Average Snow Fall (in)	63.9
Mean Annual Temperature (°F)	29.9
Low Recorded Temperature (°F)	-52
Highest Recorded Temperature (°F)	90
Freezing Index (°F-days)	3,600
Design Freezing Index (°F-days)	4,800
Thaw Index (°F-days)	2,000
Design Thaw Index (°F-days)	2,500
Heating Index (°F-days)	3,500

ii. Topography, Geology, and Soils

The community is in low-lying tundra, with numerous lake and sloughs, with alder and willow thickets along the river and some lake banks. The area has minimal topographic relief with less than 15 feet of elevation change.

The geology of the Lower Kuskokwim River consists of modern and older coastal deposits. These deposits are fine-grained materials often containing a significant organic fraction. There is discontinuous permafrost throughout the region.

The soils in the community are similar. Undisturbed areas consist of 2- to 5-foot-thick surface layers of mixed peat and organic silts. This is underlain by relatively firm inorganic silt interspersed with organic silt and finely divided organic material. Soils shallower than 20 feet have high water content and a significant amount of organics. Soils below 20 feet are firmer with less water and organics.

Permafrost is found intermittently. The permafrost is generally warm or degraded and commonly contains visible excess ice with some segregated, massive ice formations. Ice lenses up to 2 inches thick have been observed. Significant settlement is anticipated with thawing permafrost. Thawed soils are most likely degraded permafrost. Settlement should be expected with an increase in overburden pressures.[1,2]

iii. Wetlands

Lakes and sloughs are hydraulically connected to the Kuskokwim River and Kinak River and are affected by tidal fluctuations.

US Fish and Wildlife's (USFWS) National Wetlands Inventory has mapped the entire area as wetlands. The river and immediately along the river are listed as Estuarine System, subsystem subtidal, unconsolidated bottom class with a water regime of subtidal. There are several freshwater lakes in the community. Most of the community is listed as Palustrine System, emergent class, persistent subclass, scrub-shrub split class, and broad-leaved deciduous split subclass with a water regime of seasonally saturated, seasonally flooded, or seasonally flooded-tidal. Some of the higher areas are listed as Palustrine System, scrub-shrub class, broad-leaved deciduous subclass, emergent slip class, persistent split subclass with a water regime of seasonally flooded.

Any ground disturbance in the project will likely require a U.S. Army Corps of Engineers (USACE) Section 404 permit; either an individual permit or nationwide permit depending on the impact.

iv. History and Cultural

Tuntutuliak is a traditional Yup'ik Eskimo village. The Native Village of Tuntutuliak is a federally recognized tribe. The indigenous language is Central Yup'ik and maintaining the language is very important. Children are taught in Yup'ik until the third grade when classes start being taught in English. The village mainly relies on commercial fishing and a subsistence lifestyle.

[1] *Subsurface Investigation and Geotechnical Evaluation, Village Safe Water, Tuntutuliak, Alaska*. Lambe Engineers. June 1994.
[2] *Geotechnical Investigation, Heavy Duty Boardwalk Improvements, Tuntutuliak, Alaska*. Duane Miller & Associates. September 30, 2003.

The village's Yup'ik name is Tuntutuliaq, meaning "place of many reindeer." It was originally located four miles to the east and called Qinaq. In 1879, Edward Nelson, an American naturalist and ethnologist, reported a village of 175 residents. In 1945, the community moved to the present site on higher ground and renamed the community Tuntutuliak. The Bureau of Indian Affairs (BIA) school was built in 1957. A post office opened in 1960.

In 2005, a review of files and maps at the State Historical Preservation Office (SHPO) found three historic sites in or near Tuntutuliak: XBI 025 is the St. Agaphia Russian Orthodox Church and cemetery, located at the corner of Tumyarak and Agayuyarvik Streets; XBI 068, a house pit on the Kinak River 1.5 miles west of the developed community, and XBI 006, the abandoned village of Kinak, located four miles east of the developed community of Tuntutuliak.[3]

None of these sites is likely to be disturbed by the project. The project is not expected to negatively impact historical or cultural resources.

v. Wildlife

Tuntutuliak is in the Yukon Delta National Wildlife Refuge. The land immediately around the community is privately owned by the Qinarmiut Native Corporation. The refuge will not be affected by this project. There are no National Parks, Preserves, or Wild and Scenic Rivers in the project vicinity.

The area around the community is flat tundra, scrub-shrub. There are no trees in the area that could support eagle nests.

A 2005 Finding of No Significant Impact (FONSI) for the new airport found no threatened and endangered (T&E) species within the community. The USFWS website did not have T&E species habitat listed in the community.[4]

vi. Floodplains, Erosion, and Seismic Hazards

Floodplains

There are no Federal Emergency Management Agency (FEMA) flood maps for Tuntutuliak. The 100-year and 500-year floodplains have not been delineated. Tuntutuliak does not participate in the National Flood Insurance Program. Due to its history of flooding, it is assumed that all Tuntutuliak and the surrounding area is within a 500-year floodplain.

USDA RD1970-A, under authority of Executive Order 11988, states that no federally funded project should negatively impact the floodplain and should avoid development in the 500-year floodplain where practical[5]. It is reasonable to assume that there are no alternative locations outside of the 500-year floodplain within the community. Any new construction should not negatively impact the 500-year floodplain or increase the flooding risk in the community.

[3] *Tuntutuliak, Alaska, Preliminary Engineering Report, Sanitation & Boardwalk Systems.*CE2 Engineering.95% Submittal, July 2005.
[4] *Tuntutuliak Airport Relocation Stage II, Project #55695, Supplemental Findings of No Significant Impact*. ADOT&PF. December 2005.(pg. B-8)
[5] USDA. RD Instruction 1970-A. Dated April 01, 2016.

Flood

The community experiences periodic flooding. To date, the most recent flood was in October 2017. The flood of record was in 1990. Based on the 2004 Tuntutuliak Community Map, the 1990 flood elevation was -0.57 feet. In the absence of flood maps the recommended building elevations are determined by Freeboard Value Approach, which is three feet above the base elevation[6]. USACE has calculated the recommended building elevation as 2.43 feet. This recommendation is used by all federally funded projects.

Table 1.2: Community Elevations

Elevations[7]	Feet
1990 Flood of Record/Base Flood	-0.57
Recommended Building Elevation	2.43
Washeteria Ground Elevation	-1.00
Existing Washeteria Door Sill	5.73
Middle Generator Floor	3.73
Top of Generator Tank Dike	2.83
Runway East Centerline	-0.57

The Tribal Council reports that the area immediately around the WTP/washeteria has never flooded. Any new construction will likely be in or near areas that have historically flooded, and the finished floor must be above the recommended building elevation. If the building floor is above a 2.43-foot elevation, then flooding should not negatively impact the project.

Erosion

There is riverbank erosion in the community. Most of erosion occurs near boat launch areas where boardroads and buildings are being undercut. The community was included in the State's Waste Erosion Assessment and Review. The report identified several erosion areas and structures at risk. The WTP/washeteria were not included in erosions areas.

The facilities are located over 600 feet from the river and that section of river bank is stable. There are no erosion issues that should impact the project.

Seismic Hazards

Tuntutuliak is in a relatively stable seismic zone. FEMA classifies the Lower Yukon area around Tuntutuliak as seismic design category B. Residents could experience shaking of moderate intensity. Moderate shaking means "felt by all residents, with many frightened and some heavy furniture movement, but slight damage."

The area is in a Uniform Building Code (UBC) Seismic Zone 1. Seismic hazards are minimal and should not affect the design significantly.

[6] USDA. RD Instruction 1970-A. Dated April 01, 2016
[7] USACE, POACorps Map. Community Profile Tuntutuliak. http://corpsmapu.usace.army.mil/ Retrieved: 09/28/18.

c. Populations Trends[8]

The 2017 Alaska Department of Commerce, Community and Economic Development (DCCED) Certified Population is 471 residents. 48.0% of the population is under 19 years old. 44.9% is between 20 and 64 years old. 7.1% are over 65 years. The mean age is 22. 95.9% of the population reports Native American or Native Alaska combined with another race. 47.1% are female and 52.9% are male.

Table 1.3 shows the US census data since 1880. Census counts for 1980, 1910, and 1940 were not found. In 1945, the community was moved to the current location.

Table 1.3: Population Trends

Year	Population
1880	257
1890	-
1900	209
1910	-
1920	100
1930	76
1940	-
1950	68
1960	144
1970	158
1980	216
1990	300
2000	370
2010	408
2017	471

d. Community Engagement

VSW has regularly engaged the community and Tribal Council on water and wastewater issues. VSW requested funding to study a new Tuntutuliak WTP/washeteria at the request of the Native Village of Tuntutuliak.

On July 31, 2018, Daniel Nichols met with the Tuntutuliak Tribal Council. Council meeting minutes and sign in sheet are attached to the trip report in Appendix B.

[8] State of Alaska, Department of Commerce, Community, and Economic Development. Community Database Online, Tuntutuliak. https://www.commerce.alaska.gov/dcra/DCRAExternal/community Retrieved: 09/28/18.

2.0 EXISTING FACILITIES

a. Location Map

Full size Location maps of the project area are in Appendix A. Photographs of the area are in Appendix B.

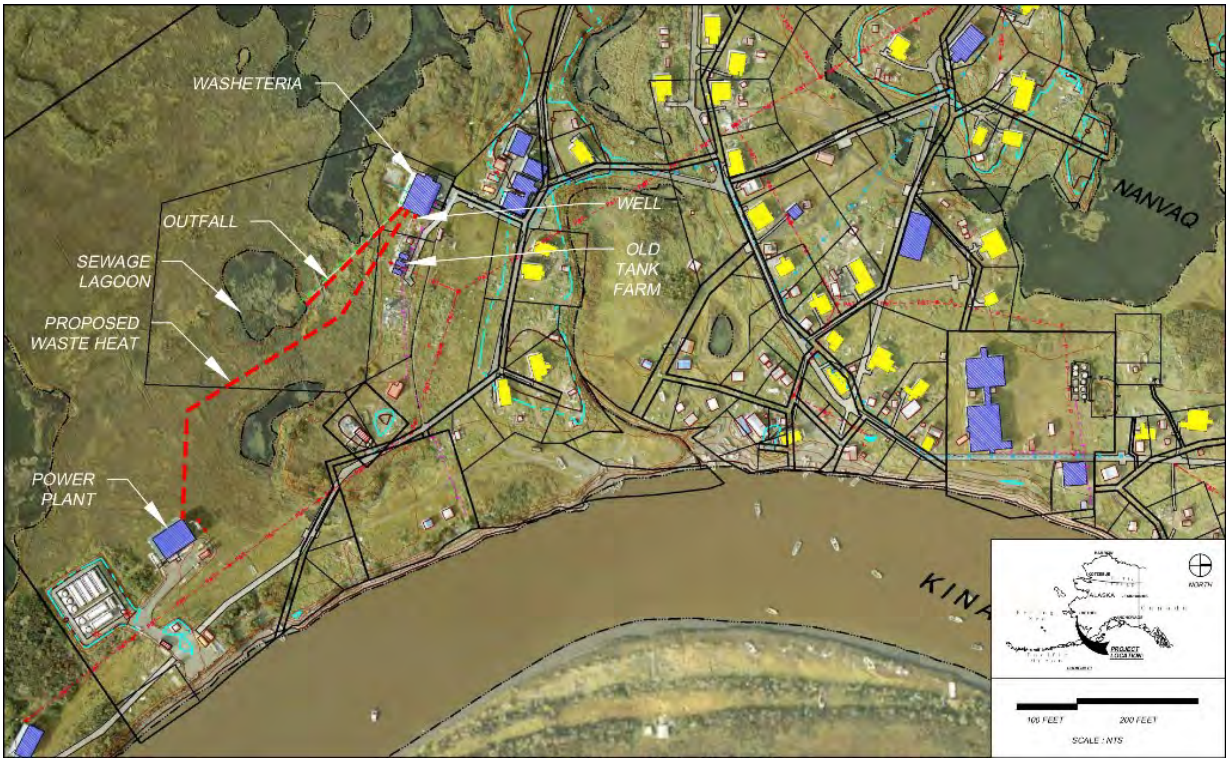


Figure 2.1: Project Area

b. History

Between 1961 and 1966, Public Health Service constructed the first sanitation facilities in the community. They included a drinking water well, 1,500 gallons of water storage, water point, privy pits, and fenced solid waste disposal area. The water was lime batch treated to remove iron. Each home was given a kitchen sink, water storage can, water carrying can, and garbage can.

In 1964 and 1965, two wells were drilled by the BIA. The wells provided plenty of water, but very poor water quality with iron more than 17 parts per million (ppm). The wells have not been used since the school was abandoned.

In the late 1970s, river bank erosion threatened the water well and treatment building. Two new wells were drilled in 1979. The first well had poor water quality (0.2 ppm arsenic and 50 ppm iron). The second well was chosen as the new water source because of higher water quality (0.1 ppm arsenic and 2.4 ppm iron). In 1980, the 1965 well eroded into the river. It was reported that privy pits in the community were full and failing.

In 1983, the current WTP/washeteria facility was constructed. It used the second 1979 well as its water source. The building measures 40 feet by 56 feet. One half consisted of the WTP and the other half the washeteria. The washeteria included four showers, two toilets, four washers, and three dryers. A tundra pond, 400 feet away, was used as a sewage lagoon. A summer-use watering point was also installed but was later removed.

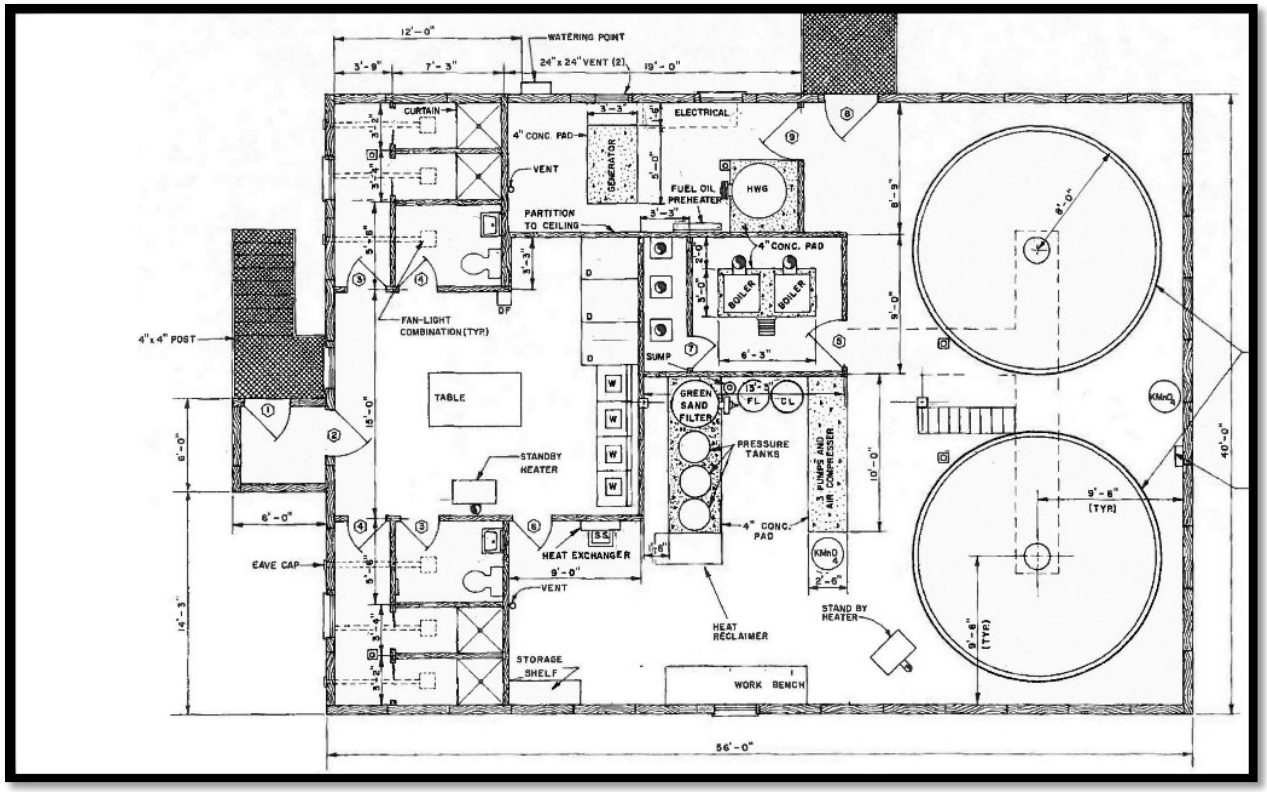


Figure 2.2: Existing Facility

Since the 1980s, new privies or honey bucket bunkers have been routinely constructed, as needed. The filled bunkers have not been properly closed. In 2019, a project was under way to close eight bunkers.

The only significant upgrade of the facility happened in 2011, with re-piping of the WTP/washeteria. The toilets, sinks, and showers were reconfigured to discharged to two new blackwater holding tanks. A new graywater lift station and holding tank was constructed inside the WTP. Only backwash water and washing machine water is discharged to the tundra pond. The tundra pond is now only used as a graywater sewage lagoon. The outfall to the lagoon was replaced. The work ended in 2014. Additional improvements were planned but funding was insufficient. The improvements included watering point, wellhead, pretreatment upgrades, and granulated activated carbon filter. In addition, a new potassium permanganate feed system, new green sand filter, air scour unit, and polymer injection system. The community reports that most of the changes have not been effective.

No wastewater discharge permit was found in the Alaska Department of Environmental Conservation's (ADEC's) database for the WTP/washeteria. Currently the WTP/washeteria only discharges greywater

into the lagoon. It appears to meet typical discharge requirements. The 2011-2014 repairs were approved by ADEC. No other upgrades or replacements have been made to the WTP/washeteria.

In 2016, as part of the VSW Unserved Communities Project, a brief concept-level assessment of a Tuntutuliak fully-piped water and sewer system was done. It included aboveground insulated pipes, lift stations, new sewage lagoon, and new water treatment plant. Its rough capital costs were estimated at $53 million or approximately $100,000 per resident. O&M costs were estimated at $441,000 annually. The monthly residential utility fee was estimated at $243 per household.[9]

Since 1980 the school has operated its own water treatment plant and sewage lagoon.

c. Conditions of Existing Facilities

The water source is a groundwater well located 20 feet west of the building. Raw water is piped to the WTP on an as-needed basis. Raw water is treated with potassium permanganate before storage in a 10,000-gallon treatment tank where oxidation and settling occur. The oxidized water is pumped from the tank through 30-inch green sand filters and disinfected. It then is stored in a 10,000-gallon treated-water storage tank. The system draws down from this tank with pressure pumps and pressure tanks. The water is piped to three locations within the building; washeteria, watering point, and haul tank fill. Figure 2.2 shows the existing floor plan.

The existing design conditions are found in Table 2.1. The WTP/washeteria is currently serving over twice the design population. People are currently using more water per day (5.3 gallons per capita-day (gpcd)) than the design estimated (4.5 gpcd). The washing machines are in high demand, and most days there is a waiting list to use the machines. During the site visit, the watering point was not functioning. It had been taken out of service in January 2018 due to contamination concerns. The community has been trying to repair the water point but as of the August 2018 site visit, it was not yet operational.

[9] CRW Engineering Group. VSW-Unserved Communities Project, Tuntutuliak Piped Water & Sewer Assessment. 4/21/2016.

Table 2.1: Summary of Existing Design Conditions

Criteria	Value
Start of Operations	1983
Design Population	223
Current Population	471
Design Number of Households	51
Current Number of Households	110
Design Average Daily Demand (gpd)	1,010
Current Average Daily Demand (gpd)	2,500
Design Average Daily Personal Usage(gpcd)	4.5
Current Average Daily Personal Usage (gpcd)	5.3
WTP/Washeteria Size (square feet)	2,240
Treatment Capacity (gpm)	12
Backwash Lagoon Size (acres)	1.4
Treatment Tank (gallons)	10,000
Treated Water Storage (gallons)	10,000
Design Days of Treated Water Storage	9
Current Days of Treated Water Storage	4
Number of Toilets (Design/Functioning)	2/1
Number of Showers (Design/Functioning)	4/1
Number of Washing Machines	4
Number of Dryers	3
Well Capacity (gpm)	12

No community members report using the WTP water for drinking, partly due to their inability to haul water from the watering point. Only the clinic and store use the haul tank fill station, but they only use WTP water for non-potable purposes. During the Tribal Council meeting and site visit it was reported that everyone uses rainwater and snowmelt for drinking water. The school has its own water system and does not rely on rainwater or snowmelt. There was interest in using the WTP for drinking water if there were a working watering point and better-quality water. The water sometimes has a heavy iron taste.

The WTP/washeteria is over 36 years old. There are signs of wear and tear from the building foundation to interior finishes. The WTP has issues or failures with boilers, backup generator, ventilation, and multiple life and safety code issues. The washeteria interior is in poor condition and only one bathroom is functioning. It also has multiple life and safety code issues. A detailed description of the condition and needs of each is found in Section 3.0 and 2018 trip report in the appendix.

d. Financial Status of any Existing Facilities

In 2014, the State's Rural Utility Business Advisor (RUBA) performed an assessment of the community's utility. A copy of the assessment is included in Appendix C.

In August 2018, the RUBA did a Best Practice score for the Tuntutuliak. The total score was 30 out of 100. The financial score was 5 out of 40.

e. Water/Energy/Waste Audits

In 2012, the Alaska Native Tribal Health Consortium (ANTHC) preformed a Comprehensive Energy Audit. The report listed five recommendations which would save $41,011 in operation costs, $1,500 in maintenance costs for an initial investment of $311,025 with a simple payback of 7.6 years. The two largest improvements were heat recovery projects from the power plant to the WTP for building heat and dryers. None of the suggested capital projects have been completed.

In 2000, a new power plant was installed 700 feet northwest of the WTP/washeteria. In 2016, a waste heat recovery system was designed by ANTHC and Tuntutuliak Community Services Association (electric utility). The intent was to provide free waste heat from the power plant to heat the WTP/washeteria. The waste heat would be supplied by insulated glycol lines. New boilers and heat exchangers would be installed at the WTP. The project has not been constructed and requires additional funding to complete. The 2016 power plant waste heat recovery project is a separate project from the 2012 audit recommendations. The waste heat recovery project would replace the energy audit's recommendations.

Table 2.2: Energy Costs[10]

Energy Costs	
Heating Oil ($/gallon)	$4.75
Gasoline ($/gallon)	$5.27
Propane ($/gallon)	$12.71
Residential Electrical Rate ($/kWh)	$0.65
Residential Electrical Rate after PCE Rate ($/kWh)	$0.46

[10] State of Alaska, Department of Commerce, Community, and Economic Development. Community Database Online, Tuntutuliak. https://www.commerce.alaska.gov/dcra/DCRAExternal/community Retrieved: 09/28/18.

3.0 NEED FOR PROJECT

a. Health, Sanitation, and Security

Health

The water has a high iron content, which exceeds the US Environmental Protection Agency's (EPA's) secondary drinking water standards. These standards are non-mandatory and are used to assist water utilities in managing drinking water aesthetics, such as taste, odor, and color. Though exceedances of the standards do not pose a health risk, they do affect the water's usability. The poor taste and iron staining of Tuntutuliak' s water are reasons why people prefer rainwater and snow melt to the WTP water.

Arsenic is a contaminant found naturally in raw waters. The EPA's arsenic maximum contaminant level (MCL) is 10 µg/L for treated drinking water. The community is supposed to annually test for arsenic in drinking water. Table 3.1 provides a summary of ADEC's test records. Arsenic levels vary greatly even between raw water samples or treated water samples. The WTP/washeteria periodically has arsenic samples that exceed the MCL. This means that sometimes the water treatment is insufficient to remove arsenic. The water treatment process needs to be improved to safeguard community health by keeping arsenic levels below MCL.

Table 3.1: Arsenic Sampling Results

Date	Concentration Level (µg/L)	Exceeds MCL	Sample Type (Raw/Treated)	Sample Description
2017	57	Yes	Treated	Public Water Dispensing Point[1]
2016	14	Yes	Treated	Tuntutuliak Washeteria
2015	10	No	Treated	Washeteria Bathroom Faucet
2015	15	Yes	Treated	Washeteria
2011	8.14	No	Treated	Treatment Area Sink
2011	13.5	n/a[2]	Raw	Tuntutuliak Raw
2010	5.04	No	Treated	Sink
2007	12.8	Yes	Treated	Treatment Area Sink
2002	37.4	n/a[2]	Raw	SP2002
2000	12.5	No[3]	Treated	001*10/23/2000
1999	6.85	No	Treated	001*01/06/1999
1993	0	No	Treated	001*04/01/1993

Notes:
1. Watering point taken off line and community is trying to fix it.
2. Raw water testing is for informational purposes and doesn't need to meet MCL.
3. Prior to 2006 MCL was 50 µg/L.

Sanitation

The Tribal Council reports that no one uses the WTP for drinking water. Only the clinic and tribal office haul water and that is for washing and toilets. The one operating washeteria shower is only used a couple times a week. People don't like using it because of its poor condition (e.g. mold, rot, damage).

Some people haul river water or use the school's showers, but most use traditional steam baths for cleaning. Not everyone has a steam bath. Families and neighbors often share steam baths. The Tribal Council reports that they often see children at school who are dirty because they lack access to bathing facilities.

The washeteria is open ten hours a day six days a week. The tribe usually has a waiting list of people wanting to use the washers with some people having to wait a day to do laundry. Residents report wearing clothes multiple times over long periods without washing because of long waits to use washers.

At the suggestion of the Tribal Council, during the 2018 site visit, Daniel Nichols met with the community health aide and clinic office assistant. The clinic reports that skin diseases such as boils and staphylococcus infections, are very common in the community. They report one to two cases a week that are severe enough to require treatment. The clinic also reports they have cases so severe the people need to be transported to Bethel or Anchorage for hospitalization. This is suggestive of a very high rate and could be as high as 10 times compared to urban communities (e.g. Anchorage) with functioning sanitation systems. These diseases are very contagious and spread easily when there isn't access to clean water. High sauna usage in Alaskan Native communities has been shown to increase risk instead of preventing staphylococcal infections[11].

The clinic also reports higher rates of digestive and respiratory complaints. A link has been found between access to clean water and the increase of risk of respiratory tract, skin, and gastrointestinal tract infections among rural Alaskan natives.[12]

Mold was observed in all the functioning showers. Mold poses a serious respiratory risk.

Security

About 100 feet west of the well, there is an old tank farm that was used for the WTP/washeteria and old power plant. In 2002, the site was added to the ADEC contaminated sites list when soil staining and surface water sheens were observed. The spill date(s), volumes, and extent are unknown. No Volatile Organic Compounds (VOC) have been found in the drinking water, including the most recent sample in 2106. The village tests for VOC every three years. ADEC does not recommend excavating the soil because it is a wetland and might increase contaminant migration. ADEC requested a proposed work plan from the community. As of September 2018, the site was on open status. There is a risk of VOC migrating to the drinking well. The current WTP is likely insufficient to remove VOCs that might enter the raw water supply. Water treatment improvements are necessary to secure the safety of drinking water.

The exterior doors of the WTP/washeteria have been damaged by vandalism. They are kept locked with padlocks from the outside. The operator cannot secure the facility when inside it and must leave the doors unlocked. The doors should be replaced.

[11] Turnidge, John. High Burden of Staphylococcal Disease in Indigenous Communities. T*he Journal of Infectious Diseases*, Volume 199, Issue 10, 15 May 2009, pages 1416-1418.
[12] United Stations Arctic Research Commission. Alaska Rural Water and Sanitation Working Group. Alaskan Water and Sanitation Retrospective, 1980-2005. February 2015.

The facility doesn't have a water discharge permit issued by ADEC. A discharge permit would be needed for any improvements.

b. Aging Infrastructure

The facility is over 36 years old. It has several severe and chronic issues which are summarized below.

Building Exterior-pile corrosion and outfall settling

The exterior of the building is in fair shape. There was no observed settling damage in the building. The foundation is on driven steel piles. There is significant corrosion on the piles. At least 1/8 inch of lost steel material was observed, which is 20% of the steel pipe's thickness. It appears the piles could start failing in the next 5-10 years. Additional studies are needed to confirm remaining life of the piles. The outfall piping has moved significantly and needs to be releveled. Only one of the three exterior lights is working.

Washeteria Interior Damage – damaged facilities, non-functioning equipment, mold and rot

The washeteria interior is in poor condition. The floor is worn down to the wood structural members. Only one bathroom and one shower are functional. The one functioning bathroom was in poor condition, with a broken mirror, vanity, and door. Mold and rot were observed in the showers and along the baseboards. Only one shower ventilation fan worked, but it is failing and should be replaced. The walls and ceiling have been patched repeatedly due to leaks and breaks. The interior sheetrock is in poor condition and should be replaced. The water fountain doesn't work. The water piping to the washers is non-functioning and washers are filled by hand using a hose.

WTP/Washeteria Code Compliance

The fire alarms and emergency lighting are expired and inoperative. The fire extinguisher needed recharging. This is a violation of International Building Code chapters 906, 907, and 1011 and a life safety issue. There was no ventilation in the building, except for windows, and most windows were no longer operable. The floor louvers for the dryers were nonfunctional and it appears the dryers are sucking air from inside the building. This is a violation of International Mechanical Code Chapter 504 and is a life safety issue. There are no ground fault circuit interrupter (GFCI) outlets or breakers in the WTP/washeteria. This is a violation of National Fire Protection Associate Chapter 70 code and is a life safety issue.

WTP Damage – boiler, leaking, equipment failures, no ventilation, backup generator, code issues

The WTP was also in poor condition. Only one of two boilers is functioning. There were small leaks and corroded glycol pipes observed throughout the building. There were numerous observed leaks and corrosion on many water pipes, valves, gauges, and pumps. The operator reports that a valve is replaced every month. In July 2018, a valve broke and flooded the WTP. The backwash air scour doesn't work due to a plugged filter; the cause is unknown. Operators have not been able to fix it. The raw water tank gauge doesn't work. Some of the piping has been replaced with PEX-style piping but it is inadequately supported, and water hammering was observed. There was no ventilation in the WTP. The lift station doesn't have adequate venting pipe and the room fills with sewage smells. Doors must be propped open to clear out the smell. The lift station and holding tanks were cleaned recently, but

the problem has not improved. The operator reports that the backup generator has not been tested recently and it appears to be unreliable.

Limited Space

The WTP has no work space except a small work bench for repair work. There is no office space or laboratory space. Records and other paperwork are stored at the tribal office. The operators need an office with a desk, computer, testing space, and space for records keeping. There is only room for a small table in the washeteria. It is used by the attendant who collects fees. There is very limited room for seating or folding laundry.

Under Capacity

The WTP/washeteria has exceeded its design capacity. The population has grown 110% above the design population of 223. The current average daily demand is 150% above the design criteria of 1,010 gpd. The current average daily personal usage has increased 18% above the design of 4.5 gpcd. The amount of treated water storage has decreased from a 9-day supply to 4-day supply. Seven days is typically the minimum days of storage required for rural water systems due to the difficulty purchasing and shipping replacement parts in the event of a breakdown.

c. Reasonable Growth

The population has grown at a steady rate since 1940. By extrapolation, the 2038 population is estimated at 583 residents.

The current facilities are servicing twice the design population. The water usage per capita has also increased about 18%. The facility cannot meet the future needs of the community.

The washeteria is significantly undersized for the usage. There need to be at least eight washing machines and six dryers to meet the current demand. The washeteria doesn't have enough area for seating or tables for folding laundry. Residents must stuff the clean clothes back into bags and carry them home.

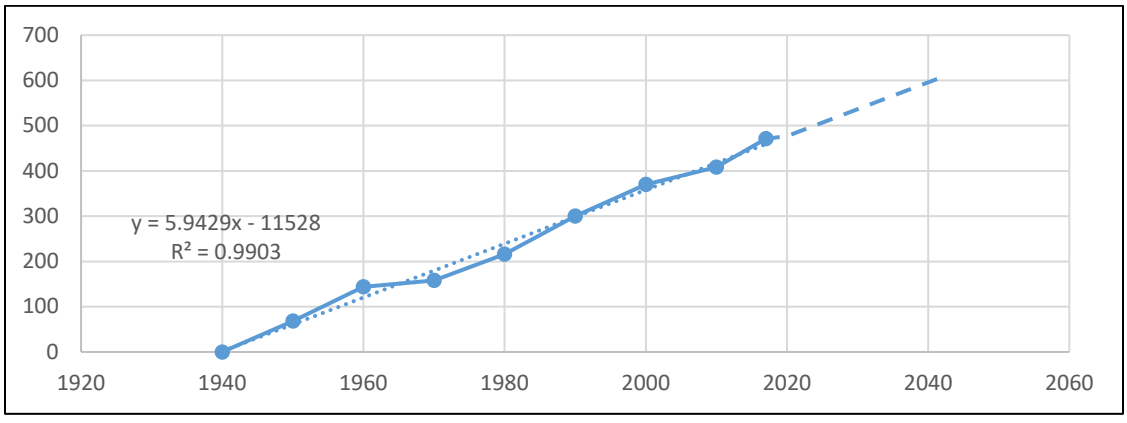


Figure 3.1: Population Growth Estimates

4.0 ALTERNATIVES CONSIDERED

a. Alternatives

In reviewing the project needs and consulting with the community and agencies, the following alternatives were considered:

1. Remodel and Expand Water Treatment and Washeteria
2. New Water Treatment Plant and Washeteria
3. New Modular Water Treatment Plant and Washeteria

The following additional alternatives were initially considered but deemed infeasible and are not discussed further.

- Do Nothing. The WTP/washeteria building is in poor condition and is well past its useful life. The piling foundation is failing due to corrosion. The facility is currently serving a population twice the design size of when it was built. There is inadequate space within the facility for treatment and the washeteria. Only one bathroom and shower work. Iron and arsenic levels are too high. The watering point is broken so people cannot haul water. People are not using the water for drinking because of the lack of access and the poor quality. There is a significant increase in skin disease and other illnesses due to the lack of access to clean water. The community health and sanitation are being negatively affected by the current conditions. For these reasons, this alternative is not feasible.
- Private Well and Septic Systems. The groundwater quality makes it difficult to find usable water. Several wells within the community have been drilled that were unfit to use as a water source. Septic systems are not practical due to the high groundwater table, poorly-draining soils, and flooding. Many housing lots are too small to have a private well and septic system with adequate separation. For these reasons, this alternative is not feasible.
- Community Piped Water and Sewer System. In 2016, a concept memo with rough cost estimates for this alternative was done. At this time, it is not being considered as an alternative for the immediate future.

b. Proposed Site Location

Any site of a proposed new facility needs to meet the following criteria:

- Within 700 feet of the power plant to take advantage of the waste heat.
- On property owned by the Village of Tuntutuliak.
- Have boardroad access.
- Have access to the well head and sewage lagoon.

Four sites were selected and reviewed during the site visit and discussed with the Tribal Council. Appendix A has a sites location map. Site 1 was selected as the preferred site. The lot's description is US Survey No. 4429, Tract A, Block 15, Lot 1, 2, & 3. The other sites were not selected for the following reasons:

- Site 2-It was adjacent to the old tank farm. There is a known contaminated site. There would be a risk of contaminating the drinking water well with any ground disturbance.

- Site 3-It is on higher, firmer ground, but is the smallest site. The outfall would have to cross a pond to access the sewage lagoon. It is also adjacent to the community's telecommunication facility. A building would block the line of sight for the ground satellite dishes.
- Site 4-Is located nearest the power plant, an optimal location for using waste heat. It is also located in a marsh area and is an area that is reported to flood regularly with high tides and storm surges. There would be greater difficulties with the foundation and permitting.

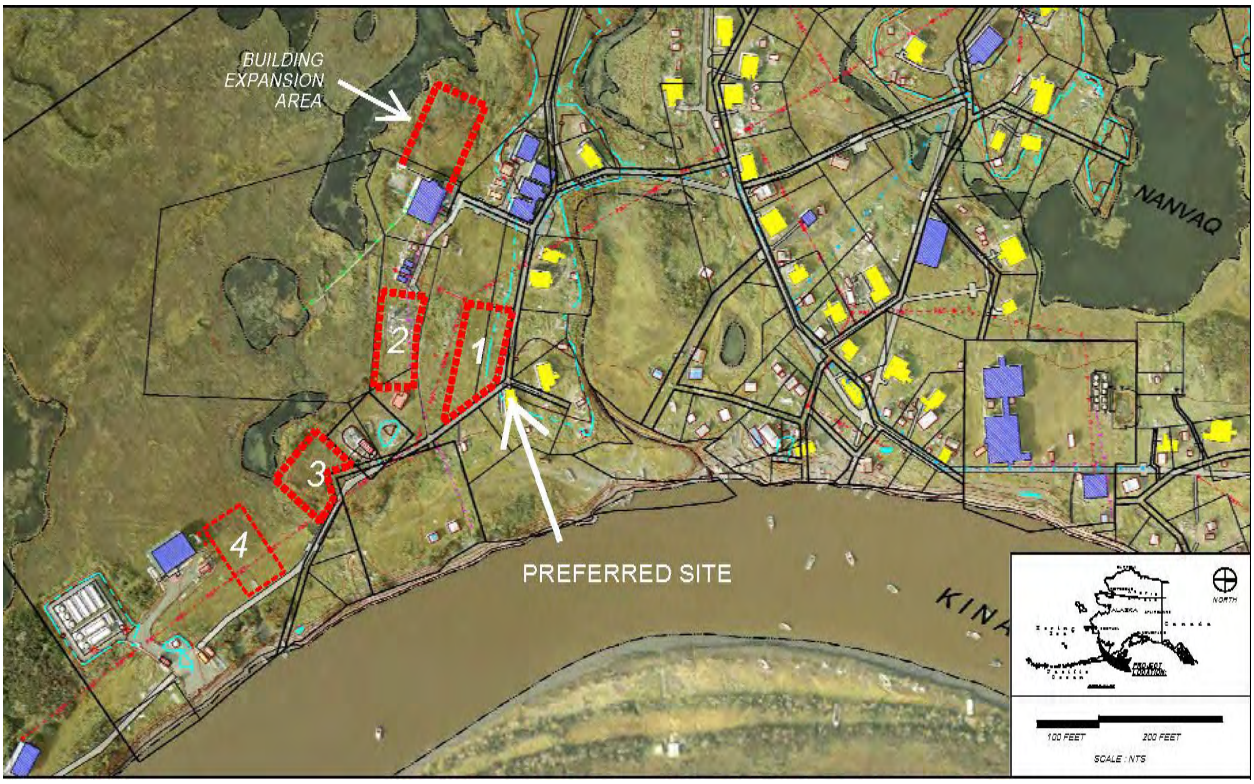


Figure 4.1: Proposed Sites

4.1. Alternative 1: Remodel and Expand Existing Water Treatment Plant & Washeteria

a. Description

This alternative includes the expansion and remodel of the existing facility. The washeteria area will almost double in size to accommodate additional washers, dryers, showers, and bathrooms. Additional space will be added for an office/storage, folding area, and waiting area. The interior will be completely remodeled. See Appendix A for an example of an expanded floor plan.

Additional space will be added for the WTP. And will provide space for an office, testing, and record keeping. The operator's office will be in the washeteria instead of the WTP due to limitations in remodeling the existing facility. The WTP will have the HVAC and backup generator replaced and be connected to the power plant's waste heat. The lift station and holding tank will have proper venting installed. The treated holding tank will be converted to an oxidizing tank. The 2011 treatment recommendations (Appendix C), which were never completed, will be added to treat the arsenic and iron issues. Most pumps, valves, and piping would be repaired or replaced. The watering point will be

replaced. The sewage outfall will be replaced. A new 100,000-gallon water storage tank and pumps will be installed.

All windows and exterior doors will be replaced. New energy-efficient exterior and interior lights will be installed. The whole building will be brought up to electrical, plumbing, fire, and safety codes. The pile foundation will be replaced or repaired.

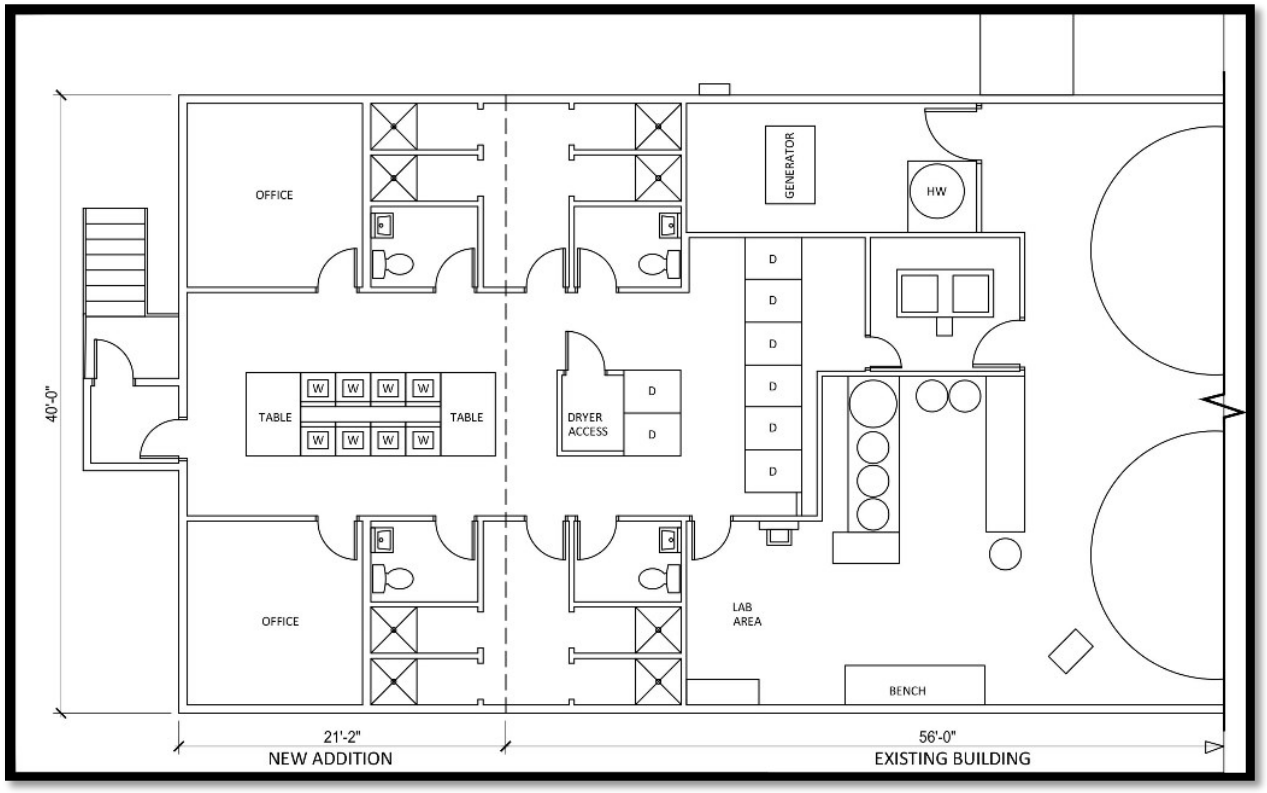


Figure 4.2: Alternative 1: Remodel and Expand Existing WTP & Washeteria

Table 4.1: Alternative 1: Remodel and Expand WTP & Washeteria Major Components

Alternative 1-Major Components	
Washeteria Addition (square feet)	844
Additional Showers Area	49
Additional Bathrooms Area	84
Additional Dryers & Dryer Area	162
Office, Seating, Folding, Storage Areas	189
Water Treatment Plant Addition (square feet)	360
Total Building Addition	844
New Treated Water Storage Tank	100,000

b. Design Criteria

The following table contains the design criteria.

Table 4.2: Alternative 1: Remodel and Expand WTP & Washeteria Design Criteria

Alternative 1-Design Criteria	
Design Population	583
Design Life (years)	20
Average Daily Flow Rate (gpcd)	25
Average Daily Water Usage (gpd)	13,260
Average Weekly Laundry Rate (lb/capita)	20
Average Weekly Laundry Rate (lbs)	11,660
Water Storage (gallons)	100,000
Days of Storage (minus 16% ice volume)	7
Number of Bathrooms	4
Number of Showers	8
Number of 4.5 ft^3 Washers (20 lbs per load)	8
Number of 8.0 ft^3 Dryers	8

c. Map

Location maps are in Appendix A.

d. Environmental Impacts

- There is a contaminated site west of the facility at the old tank farm. There is a small risk that construction around the facility could damage the tundra and cause contaminants to migrate towards the well. This risk could be reduced by doing ground disturbance during the winter.
- The proposed area is reported by the community never to have flooded. The existing floor elevation is above the USACE-recommended finished floor elevation.
- No erosion issues.
- No archeological or cultural impacts.
- The entire community is wetlands. Any ground work would need to follow USACE regulations.
- The project would disturb less than ¼ acre.
- This alternative would require a USACE nationwide permit, ADEC water project approvals to construct and operate, and ADEC wastewater discharge permits.
- The environmental impact for this alternative is minimal.

e. Land Requirements

The existing facility is located on US Survey No.4429, Track A, Block 14, Lot 4. The lot is limited in size. It is also bounded along the north by a tundra pond and along the west by the old fuel farm site. The only area available for expansion is to the east. Any expansion east would encroach on the adjacent Lot 1 and would provide only minimal additional room. Lot 4 and Lot 1 would have to be re-platted to include the expanded building.

f. Potential Construction Problems

- The renovation effort necessary for this alternative would be very significant. With any renovation there are a lot of unknowns, especially with a building over 35 years old. Much of the design would have to be vague because accurate as-builts do not exist. There is a high chance significant unknown issues will arise during construction, which will increase the construction cost.
- The piles need to be replaced. It is very difficult to replace piles without damaging the building or causing settling. The building structural components may need to be reinforced prior to replacing the foundation.
- The soils within the community are poor. Settlement and movement are very common. The expansion's foundation will need to match the replacement foundation. Differential settlement between two foundations is common when a building is expanded. This could lead to damage such as cracking, floor jacking, inoperative windows, doors that won't shut, etc.
- The condition of the building structure is unknown. During design or construction, the roof or floor trusses may be found to be rotted or require replacement. It is typical in older buildings to have to replace or reinforce structural members. The biggest risk is to the construction schedule and budget.

g. Sustainability Considerations

i. Water and Energy Efficiency

This alternative would incorporate the existing power plant waste heat project, which would reduce the existing energy usage to heat the building. New boilers would also decrease the energy usage and costs. Remodeling would replace lights with more energy-efficient fixtures. Overall the energy efficiency would increase but would still be less than a new facility, since the existing structure is not as insulated and is older.

ii. Green Infrastructure

Not applicable.

iii. Other

None.

h. Cost Estimates

This is the alternative's cost estimate rounded to the nearest $1,000. See cost estimate in Appendix D for details.

Table 4.3: Alternative 1: Remodel and Expand WTP & Washeteria Cost Estimates

Item	Cost
Construction (Capital) Costs	$4,386,000
Non-Construction Costs	$1,220,000
Total Costs	$5,606,000
O&M Costs (Annual)	$184,000

4.2. Alternative 2: New Water Treatment Plant & Washeteria

a. Description

This alternative includes a new wood-framed WTP/washeteria built on site. This WTP/washeteria would be located on a new drive pile foundation. The piles would be driven in the spring or late fall when the ground is frozen. Most of the construction would be done on site. This would allow for more local labor to be utilized.

A pilot study is recommended to optimize the new treatment process. For cost estimating we assume the same treatment process with the 2011 recommended modifications.

The WTP would be connected to the well by an aboveground insulated pipe. A new aboveground insulated outfall would be installed and would discharge into the existing lagoon. Blackwater would be collected into holding tanks and hauled to the community sewage lagoon.

The building would be connected to the power plant's waste heat.

A new 100,000-gallon water storage tank would be constructed next to the new building.

The existing boardwalk would be reconstructed to provide access and parking.

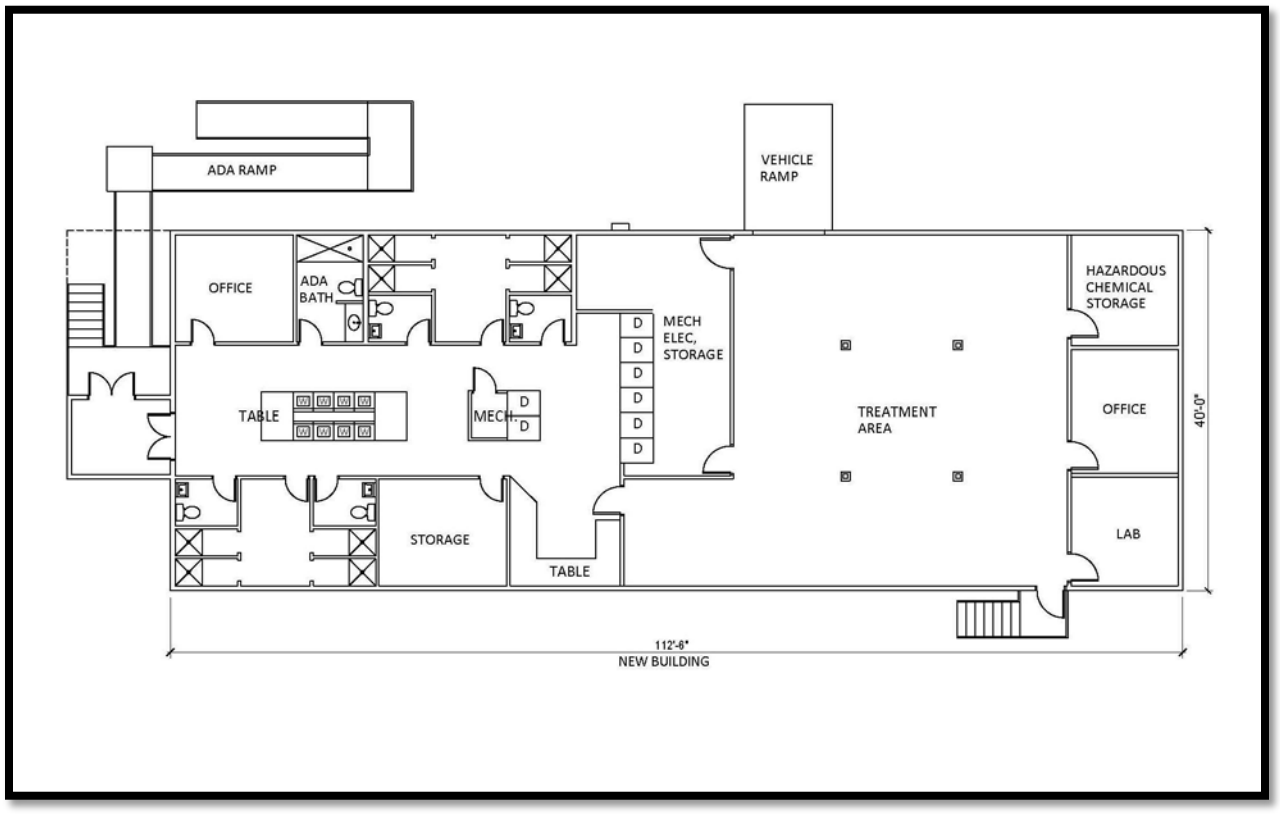


Figure 4.3: Alternative 2: New WTP & Washeteria

Table 4.4: Alternative 2: New WTP & Washeteria Major Components[13]

Alternative 2-Major Components	
Building Size (square feet)	4,500
Number of Foundation Piles	80
Storage Tank Volume (gallons)	100,000
Raw Water Pipe (feet)	200
Discharge Water Pipe (feet)	250
Boardwalk (square feet)	1,500

b. Design Criteria

The following table contains the design criteria.

Table 4.5: Alternative 2: New WTP & Washeteria Design Criteria[14]

Alternative 2-Design Criteria	
Design Population	583
Design Life (years)	20
Average Daily Flow Rate (gpcd)	25
Average Daily Water Usage (gpd)	13,260
Average Weekly Laundry Rate (lb/capita)	20
Average Weekly Laundry Rate (lbs)	11,660
Water Storage (gallons)	100,000
Days of Storage (minus 16% ice volume)	7
Number of Bathrooms	4
Number of Showers	8
Number of 4.5 ft^3 Washers (20 lbs per load)	8
Number of 8.0 ft^3 Dryers	8

c. Map

Location maps are in Appendix A.

d. Environmental Impacts

- There is a contaminated site west of the facility at the old tank farm. There is a small risk that construction of the new outfall could damage the tundra and cause contaminants to migrate towards the well. This risk could be reduced by doing ground disturbance during the winter.
- The proposed area is reported by the community never to have flooded. It is approximately 2 feet higher than the existing facility site. The floor elevation would have to be above the USACE recommended finished floor elevation.
- No erosion issues.

[13] Table 4.4 has the same values as Table 4.7 since Alternative 2 & 3 are similar.
[14] Table 4.5 has the same values as Table 4.8 since Alternative 2 & 3 have same design criteria.

- No archeological or cultural impacts.
- The entire community is wetlands. Any ground work would need to follow USACE regulations.
- The project would disturb less than ¼ acre.
- This alternative would require a USACE nationwide permit, ADEC water project approvals to construct and operate, and ADEC wastewater discharge permits.
- The environmental impact for this alternative is minimal.

e. Land Requirements

The proposed site would include US Survey No. 4429, Tract A, Block 15, Lot 1, 2, & 3. The lots are owned by the Village of Tuntutuliak. The outfall would have to cross over US Survey No. 4429, Tract A, Block 14, Lot 5. This lot is also owned by the Village. It would be recommended that a utility right of way (ROW) be obtained for the outfall and Lots 1, 2, 3 be re-platted as necessary to place the new facility on one unified lot.

f. Potential Construction Problems

- There are no soil data from the preferred site. Unconsolidated organic soils, and silts are known to be in the area. A driven steel pile foundation similar to the existing facility is assumed. A geotechnical investigation should be completed during the pre-design phase to confirm this.
- Wood-framed buildings are at a greater risk of differential settlement damage than modular buildings. A more expensive and stabile foundation than modular construction would require may be necessary.
- Wood-framed construction will require several additional months of on-site construction time than modular construction would require. This will increase the worker costs during construction. It also increases the risk that the project may get delayed due to weather, flooding, or other conditions. However, it would provide more jobs within the community than modular construction.
- There is a limited work force within the community. It may be difficult at the time of construction for a contractor to find enough skilled local hires. This would require additional outside workers to be brought onto the site. This would increase the construction costs due to contractor paying room, board, and travel costs for outside workers.

g. Sustainability Considerations

i. Water and Energy Efficiency

This alternative would incorporate the existing power plant waste heat project, which would reduce the existing energy usage to heat the building. The new facility would include high efficiency boilers as backup, the latest insulation, and a tight building envelope. It will be significantly more energy efficient than the existing building.

ii. Green Infrastructure

Not applicable.

iii. Other

None.

h. Cost Estimates

This is the alternative's cost estimate rounded to the nearest $1,000. See cost estimate in Appendix D for details.

Table 4.6: Alternative 2: New WTP & Washeteria Cost Estimates

Item	Cost
Construction (Capital) Costs	$5,307,000
Non-Construction Costs	$1,485,000
Total Costs	$6,792,000
O&M Costs (Annual)	$132,000

4.3. Alternative 3: New Modular Water Treatment Plant & Washeteria

a. Description

This alternative includes a new modular WTP/washeteria. The modular elements would be constructed and shipped to site. This WTP/washeteria would be located on a new driven-pile foundation. The modular structure would be skid mounted and attached to the piles. Each module would be mounted on a skid. The contractor would drag the individual modules to the site where the modules would be assembled.

A pilot study is recommended to optimize the new treatment process. For cost estimating we assume the same treatment process with the 2011 recommended modifications.

The WTP would be connected to the well by an aboveground insulated pipe. A new aboveground insulated outfall would be installed and would discharge into the existing lagoon. Blackwater would be collected into holding tanks and hauled to the community sewage lagoon.

The building would be connected to the power plant's waste heat.

A new 100,000-gallon water storage tank would be constructed next to the new building.

The existing boardwalk would be reconstructed to provide access and parking.

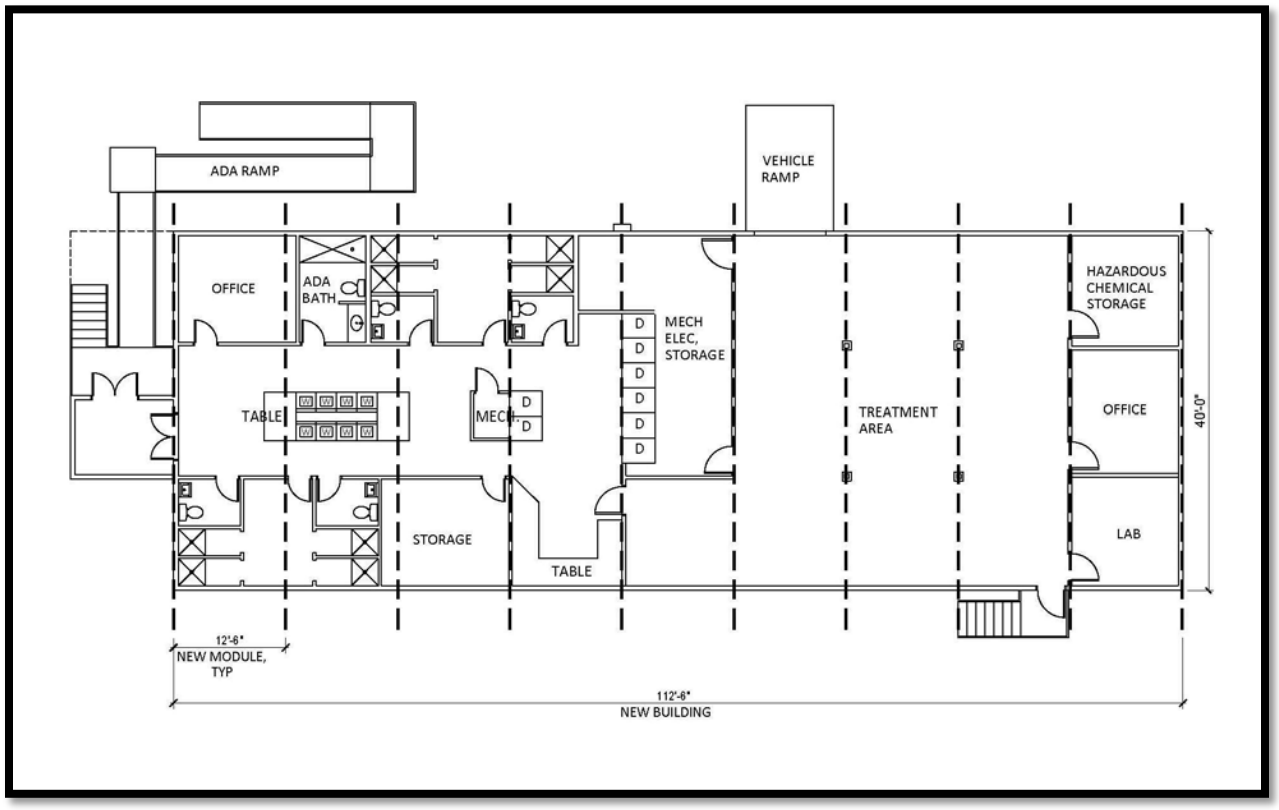


Figure 4.4: Alternative 3: New Modular WTP & Washeteria

Table 4.7: Alternative 3: New Modular WTP & Washeteria Major Components

Alternative 3-Major Components	
Building Size (square feet)	4,500
Number of Foundation Piles	80
Storage Tank Volume (gallons)	100,000
Raw Water Pipe (feet)	200
Discharge Water Pipe (feet)	250
Boardwalk (square feet)	1,500

b. Design Criteria

The following table contains the design criteria.

Table 4.8: Alternative 3: New Modular WTP & Washeteria Design Criteria

Alternative 3-Design Criteria	
Design Population	583
Design Life (years)	30
Average Daily Flow Rate (gpcd)	25
Average Daily Water Usage (gpd)	13,260
Average Weekly Laundry Rate (lb/capita)	20
Average Weekly Laundry Rate (lbs)	11,660
Water Storage (gallons)	100,000
Days of Storage (minus 16% ice volume)	7
Number of Bathrooms	4
Number of Showers	8
Number of 4.5 ft^3 Washers (20 lbs per load)	8
Number of 8.0 ft^3 Dryers	8

c. Map

Location maps are in Appendix A.

d. Environmental Impacts

- Environmental impacts are same as Alternative 2.
- There is a contaminated site west of the facility at the old tank farm. There is a small risk that construction of the new outfall could damage the tundra and cause contaminants to migrate towards the well. This risk could be reduced by doing ground disturbance during the winter.
- The proposed area is reported by the community never to have flooded. It is approximately 2 feet higher than the existing facility site. The floor elevation would have to be above the USACE recommended finished floor elevation.
- No erosion issues.
- No archeological or cultural impacts.
- The entire community is wetlands. Any ground work would need to follow USACE regulations.

- The project would disturb less than ¼ acre.
- This alternative would require a USACE nationwide permit, ADEC water project approvals to construct and operate, and ADEC wastewater discharge permits.
- The environmental impact for this alternative is minimal.

e. Land Requirements

The proposed site would include US Survey No. 4429, Tract A, Block 15, Lot 1, 2, and 3. The lots are owned by the Village of Tuntutuliak. The outfall would have to cross over US Survey No. 4429, Tract A, Block 14, Lot 5. This lot is also owned by the Village. It would be recommended that a utility ROW be obtained for the outfall and Lots 1, 2, and 3 be re-platted as necessary to place the new facility on one unified lot.

f. Potential Construction Problems

- There are no soil data from the preferred site. Unconsolidated organic soils, and silts are known to be in the area. A driven steel pile foundation like the existing facility is assumed. A geotechnical investigation should be completed during the pre-design phase to confirm.
- Modular buildings are at less of a risk from differential settlement damage than wood-framed buildings due to the rigid skid foundation.
- Modular construction is mostly constructed at a controlled site, then shipped into the community. This reduces the on-site construction efforts and time, but it must make seasonal barges. For wood framed construction, if materials are delayed, they can easily be flown into the community. It would be very difficult and expensive to air freight modular buildings.
- There is a limited work force within the community. Modular construction requires fewer specialized workers for the on-site work. It will be easier for a contractor to use the local work force. This will reduce construction costs.

g. Sustainability Considerations

i. Water and Energy Efficiency

This alternative would incorporate the existing power plant waste heat project, which would reduce the existing energy usage to heat the building. The new facility would include high efficiency boilers as backup, latest insulation, and a tight building envelope. It will be significantly more energy efficient than the existing building.

ii. Green Infrastructure

Not applicable.

iii. Other

None.

h. Cost Estimates

This is the alternative's cost estimate rounded to the nearest $1,000. See cost estimate in Appendix D for details.

Table 4.9: Alternative 3: New Modular WTP & Washeteria Cost Estimates

Item	Cost
Construction (Capital) Costs	$6,131,000
Non-Construction Costs	$1,686,000
Total Costs	$7,816,000
O&M Costs (Annual)	$132,000

5.0 SELECTION OF AN ALTERNATIVE

This section analyzes the alternatives in a systematic manner using both monetary and non-monetary factors. Monetary factors include construction costs, non-construction costs, operations and maintenance (O&M) costs, and life cycle costs. Non-monetary factors may include health, social, economic, environmental, sustainability, or risk factors.

From this analysis, an alternative is selected for recommendation. The recommended alternative is then developed into a project described in Section 6.0.

a. Life Cycle Costs Analysis

A life cycle cost analysis for each alternative is presented in Table 5.1. The analysis includes construction costs, O&M costs, and short-lived assets costs. O&M costs include annual cost for the entire design life. Short-lived assets include costs associated with disposable items or replacement parts needed throughout the design life. All costs are shown at present values.

Table 5.1: Life Cycle Costs Analysis[15]

Costs	Alt 1-Remodel and Expand WTP/Washeteria	Alt 2-New WTP/Washeteria	Alt 3-New Modular WTP/Washeteria
Construction (Capital) Costs	$4,386,000	$5,307,000	$6,131,000
Non-Construction Costs	$1,220,000	$1,485,000	$1,686,000
Total Project Costs	**$5,606,000**	**$6,792,000**	**$7,816,000**
O&M Costs (Annual)	$184,000	$132,000	$132,000
Life Cycle Costs	$7,011,000	$5,842,000	$6,262,000

b. Non-Monetary Factors

Non-monetary factors have a significant impact on the success of a project. Table 5.2 quantifies the identified non-monetary factors. The engineer, in consultation with the owner, community, and agencies, assigns a numerical value to each factor from 1 to 5 with one being the most desirable alternative and 5 being the least desirable alternative. The alternative with the lowest overall score is the most desirable non-monetarily.

[15] Detailed cost estimates found in Appendix D.

Table 5.2: Quantitative Analysis of Non-Monetary Factors

Alternatives	Alt 1-Remodel and Expand WTP/Washeteria	Alt 2-New WTP/Washeteria	Alt 3-New Modular WTP/Washeteria
Quality of Life Improvements	2	1	1
O&M Effort	3	1	1
Local Hire Potential	2	2	3
Construction Risks	4	2	1
Community Support	5	1	1
Totals	**16**	**7**	**7**

The non-monetary factors are defined as follows:

- Quality of Life Improvements: How the alternative improves the daily lives of residents related to effort spent obtaining clean water and ease of access. How the alternative improves health, safety, and hygiene within the community.
- O&M Effort: The relative effort and difficulty for the community to operate and maintain the alternative. How much extra effort will it take? How will it impact the current operations?
- Local Hire Potential: What is the potential for local hire during construction? How much will the alternative add to the local economy?
- Construction Risks: The design is not completed. What is the likelihood that issues with construction would increase the costs or schedule? How difficult is the alternative to construct? Are there specialized equipment, techniques, or materials needed?
- Community Support: Does the community water the alternative? Which alternative is preferred? Is there an alternative that the community doesn't support?

The following tables summarizes the advantages and disadvantages of each alternative for comparison.

Table 5.3: Alternatives Advantages & Disadvantages Summary

Alt	Description	Advantages	Disadvantages
1	Remodel & Expand WTP/Washeteria	Lowest construction costs	Highest O&M cost, riskiest, least amount of improvement, shortest design life, low community support
2	New WTP/Washeteria	Lowest life cycle costs, highest level of service, highest community support, lowest O&M effort, high local hire potential	High capital cost
3	New Modular WTP/Washeteria	Highest level of service, high community support, lowest O&M effort	Highest capital & life cycle costs, lower local hire potential

6.0 PROPOSED PROJECT (RECOMMENDED ALTERNATIVE)

This section provides recommendations for which alternative should be implemented. The selected alternative is developed into a proposed project. The proposed project is a road map for Tuntutuliak and VSW to guide them from planning through construction. This section summarizes the project plan.

a. Preliminary Project Design

The recommended alternative is Alternative 3: New Water Modular Treatment Plant & Washeteria.

The proposed project includes a modular WTP/washeteria. This WTP/washeteria would be located on a new driven-pile foundation. Each module would be mounted on a skid. The contractor would drag the individual modules to the site where the modules would be assembled.

A pilot study is recommended to optimize the new treatment process. For cost estimating we assume the same treatment process with the 2011 recommended modifications.

The WTP would be connected to the well by an aboveground insulated pipe. A new aboveground insulated outfall would be installed and would discharge into the existing lagoon.

The building would be connected to the power plant's waste heat.

A new 100,000-gallon water storage tank would be constructed next to the new building.

The existing boardwalk would be reconstructed to provide access and parking.

Table 6.1: Proposed Project-New Modular WTP & Washeteria Major Components

New WTP & Washeteria-Major Components	
Building Size (square feet)	4,500
Number of Foundation Piles	80
Storage Tank Volume (gallons)	100,000
Raw Water Pipe (feet)	200
Discharge Water Pipe (feet)	250
Boardwalk (square feet)	1,500

b. Project Schedule

The proposed project schedule is outlined in a Gantt chart in Appendix E. Table 6.2 summarizes the project schedule.

Table 6.2: Proposed Project-New Modular WTP & Washeteria Project Schedule

Phase	Schedule
PER & ER	January 2019
Secure Funding	June 2019-March 2020
Pre-Engineering	March -September 2020
Engineering	June-December 2020
Permitting	November-December 2020
Bidding	January 2021
Contracting	February 2021
Mobilization	March-June 2021
Construction	May 2021-May 2022
Commissioning	June 2022

c. Permit Requirements

The following permits and agency approvals are anticipated to be required for the project:

- USACE Section 404 Nationwide Permit
- ADEC Approval to Construct
- ADEC Approval to Operate
- ADEC wastewater discharge permit

d. Sustainability Considerations

i. Water and Energy Efficiency

This alternative would incorporate the existing power plant's waste heat project, which would reduce the existing energy usage to heat the building. The new facility would include high efficiency boilers as backup, the latest insulation, and a tight building envelope. It will be significantly more energy efficient than the existing building.

ii. Green Infrastructure

Not applicable.

iii. Other

None.

e. Total Project Cost Estimate (Engineer's Opinion of Proposed Project Costs)

The following tables summarize the construction and non-construction costs for the proposed project.

Table 6.3: Proposed Project-New Modular WTP & Washeteria Construction (capital) Costs

Construction (Capital) Costs				
Item	No.	Unit	Cost	Total
Mob & Demo	1	LS	$1,000,000	$1,000,000
Construction Survey	1	LS	$5,000	$5,000
Boardwalk & Board Parking	1,500	SQFT	$20	$30,000
Site Electrical	1	LS	$30,000	$30,000
Access Ramp	1	LS	$20,000	$20,000
Modular Washeteria	4,500	SQFT	$600	$2,700,000
New Foundation	1	LS	$100,000	$100,000
Washeteria Equipment	1	LS	$50,000	$50,000
WTP- Equipment	1	LS	$200,000	$200,000
WTP-HVAC	1	LS	$20,000	$20,000
Power Plant Waste Heat	1	LS	$513,000	$513,000
Emergency Generator	1	LS	$12,000	$12,000
Day Tank	1	LS	$8,000	$8,000
Tank Foundation-Gravel	600	CYD	$100	$60,000
Tank Foundation-Thermal Syphons	1	LS	$45,000	$45,000
New Water Storage Tank	1	LS	$300,000	$300,000
Yard Piping	1	LS	$10,000	$10,000
New Outfall Piping	260	FT	$400	$104,000
New Raw Water Piping	175	FT	$200	$35,000
Water Haul Trailer	1	LS	$20,000	$20,000
Commissioning	1	LS	$10,000	$10,000
O&M Manual & Training	1	LS	$10,000	$10,000
O&M Equipment	1	LS	$2,500	$2,500
			Subtotal	$5,284,500
Resident Project Representative	4%	of	$5,284,500	$211,380
Construction Administration	6%	of	$5,284,500	$317,070
Project Administration	6%	%	$5,284,500	$317,070
			Subtotal	$845,520
Total			$6,130,020	

Table 6.4: Proposed Project-New Modular WTP & Washeteria Non-Construction Costs

Non-Construction Costs				
Item	No.	Unit	Cost	Total
Survey	1	LS	$20,000	$20,000
Geotechnical	1	LS	$60,000	$60,000
Land Acquisition/ROW	1	LS	$5,000	$5,000
Engineering	10%	of	$5,284,500	$528,450
Permitting	1	LS	$15,000	$15,000
Project Contingency	20%	of	$5,284,500	$1,056,900
Total	$1,685,350			

Table 6.5: Project Project-New WTP & Washeteria Cost Summaries (Round Up)

Item	Cost
Construction (Capital) Costs	$6,131,000
Non-Construction Costs	$1,686,000
Total Costs	$7,816,000
O&M Costs (Annual)	$132,00

f. Annual Operating Budget

This report covers the annual operating budget for the water system. The community will need to have an updated business plan that covers both water and sewer in the future.

i. Income

Historically, there have been three revenue sources for the water utility: water haul, water point, and washeteria usage. Currently the only revenue source is washeteria usage which includes washers, dryers, and showers. The washeteria revenue is down significantly because the condition and capacity of the washeteria is limiting its usage. A 2005 water, sewer, and solid waste business plan is the most recent available data for all three revenue sources.

The following table is projected income for a new WTP/washeteria facility with a water haul system. The estimate is for the initial years. It is assumed that not everyone in the community will immediately switch from rainwater to the community water source.

Table 6.6: Proposed Project-New Modular WTP & Washeteria Annual Income

Revenue Source	Amount	Unit	Rate	Collection Rate	Total
Washeteria[1]					
Showers[2]	1,248	Shower	$5	100%	$6,240
Washers[3]	9,360	Load	$5	100%	$46,800
Dryers[4]	4,680	Load	$7	100%	$32,760
				Subtotal	$85,800
Water					
Residential Water Delivery[6]	1,300	Delivery[5]	$35	65%	$29,575
Small Commercial Water Delivery[7]	60	Delivery[5]	$35	95%	$1,995
Clinic[8]	52	Delivery[5]	$35	100%	$1,820
Watering Point (self haul)[9]	520,000	Gallon	$0.05	100%	$26,000
				Subtotal	$59,390
				Total Revenue	$145,190

Assumptions

1. Washeteria currently open 6 days a week, 10 hours a day.
2. Four showers per day
3. 30 loads per day
4. 15 loads per day.
5. Delivery is 100 gallons per day.
6. Weekly delivery for 25 homes.
7. Monthly delivery for 3 commercial users.
8. One weekly delivery.
9. 200 gallons weekly haul for 50 homes

ii. Annual O&M Costs

Table 6.7: Proposed Project-New Modular WTP & Washeteria Annual O&M Budget

Operations & Maintenance Costs (Annual)				
Item	No.	Unit	Cost	Total
WTP Personnel	1000	HR	$30	$30,000
Washeteria Personnel	3,120	HR	$15	$46,800
Water Haul Personnel	676	HR	$30	$20,280
Administrative Costs	1	LS	$8,000	$8,000
Disposable Materials	1	LS	$5,000	$5,000
Workman's Comp	47.96	100 HR	$3	$132
Insurance (bldg, general)	1	LS	$2,000	$2,000
Heating Costs (oil fuel)	1	LS	$15,000	$15,000
Energy Costs (electric)	1	LS	$4,000	$4,000
Total	$131,212			

The tribe has one fulltime employee whose responsibilities include sewage hauling, facilities maintenance, and boardroad maintenance. The tribe does not currently haul water. Water haul efforts are estimated at 13 hours per week. It is likely that the tribe will need to hire an additional temporary employee for water hauling.

The water utility will operate at a profit of less than $14,000. $14,000 would be used for emergency or unforeseen expenses.

iii. Debt Repayment

This project is expected to be funded by grants. Loans will not be used to finance these improvements, and therefore, debt repayment is not anticipated.

iv. Reserves

This project will be funded by grants. There is no requirement for a General Obligation bond, loan security, or cash reserves.

7.0 CONCLUSIONS AND RECOMMENDATIONS

Village Safe Water (VSW) and Tuntutuliak Traditional Council contracted with Kuna Engineering in June 2018 to develop a PER to bring the community water system into arsenic and lead compliance and improve access to sanitation facilities by replacing the WTP/washeteria. The project was funded by the US Department of Agriculture, Rural Utilities Service (USDA-RUS) and VSW. This PER was prepared using USDA-RUS Bulletin 1780-2.

Tuntutuliak, which has a population of 471, is located on the Kinak River (Qinaq River), approximately five miles from its confluence with the Kuskokwim River. The community is about 40 miles from the Bering Sea and 40 miles southwest of Bethel, the regional hub. Tuntutuliak is off the road system and is only accessible by water and air.

The WTP/washeteria facility was constructed in 1983 and uses a well as its water source. The building measures 40 feet by 56 feet. One half consists of the WTP and the other half the washeteria. The washeteria includes four showers, two toilets, four washers, and three dryers. A tundra pond, 400 feet away, is used for a greywater sewage lagoon. The only significant upgrade of the facility happened in 2011 with re-piping of the WTP/washeteria. Detailed description of the WTP/washeteria is found in Section 3.0.

The WTP/washeteria is over 36 years old. There are significant issues or failures with boilers, backup generators, ventilation, life and safety codes, sizing, building deterioration, and arsenic/lead levels. Currently residents are not using water from the WTP for drinking because of poor access and quality. The washeteria is undersized by over 50% and only the laundry facilities are being fully used. A detailed description of the project needs is found in Section 4.0

In reviewing the project needs and consulting with the community and agencies, this PER analyzed the following alternatives:

1. Remodel and Expand Water Treatment and Washeteria
2. New Water Treatment Plant and Washeteria
3. New Modular Water Treatment Plant and Washeteria

After reviewing and analyzing the alternatives, Alternative 3: New Modular Water Treatment Plant and Washeteria is recommended as the best alternative to meet the community's needs. The community and VSW concur with the recommendation. A detailed description of the recommended alternative is found in Section 4.0 and a description of the project plan is found in Section 6.0.

Proposed Project: New Modular Water Treatment Plant & Washeteria

The proposed project includes a new modular WTP/washeteria. The modular elements would be constructed and shipped to site. This WTP/washeteria would be located on a new driven-pile foundation. Each module would be mounted on a skid. The contractor would drag the individual modules to the site where the modules would be assembled and attached to the piles. A pilot study is recommended to optimize the new treatment process. For cost estimating we assume the same treatment process from the 2011 recommended modifications, which include pretreatment upgrades, a potassium permanganate feed system, a new greensand filter, an air scour unit, a rehabilitated existing filter as granulated activated carbon (GAC) filter, and a polymer injection system.

The WTP would be connected to the well and the existing sewage lagoon by aboveground insulated pipes. A new aboveground insulated outfall would be installed and would discharge into the existing lagoon. Blackwater would be collected into holding tanks and hauled to the community sewage lagoon. A new 100,000-gallon water storage tank would be constructed next to the new building. The building would be connected to the power plant's waste heat.

Table 7.1: Proposed Project Cost Summary

Proposed Project Cost Summary	
Construction Costs	$6,131,000
Non-Construction Costs	$1,686,000
Total Project Cost	$7,816,000

Table 7.2: Annual Proposed Budget Summary

Annual Proposed Budget Summary	
Revenue	$145,000
O&M Costs	$131,000
Net Annual Budget	$14,000

Table 7.3: Proposed Project Schedule Summary

Proposed Project Schedule Summary	
Secure Funding Date	March 2020
Design Schedule (if funded)	April 2020-December 2020
Construction Schedule (if funded)	May 2021-May 2022
Project Completion Date (if funded)	June 2022

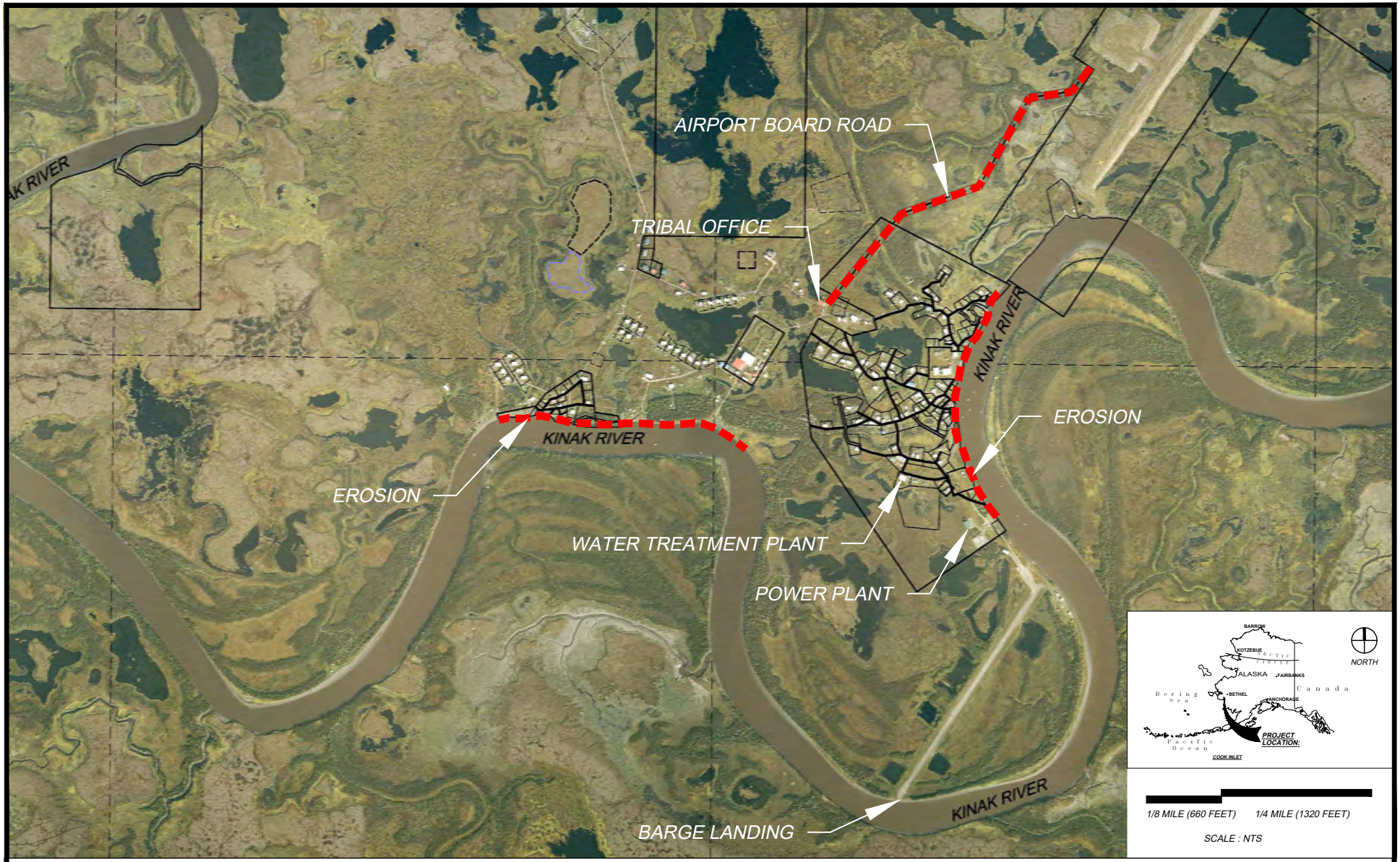
APPENDIX

Contents:

Appendix A: Vicinity, Community, and Location Maps

Contents:

95% DRAFT REPORT



WATER IMPROVEMENTS

TUNTUTULIAK, AK WATER IMPROVEMENTS
PRELIMINARY ENGINEERING REPORT

PROJ. NO.	165.030039
DRAWN	TRP
CHECKED	DEN
DATE	12/27/18

KUNA ENGINEERING

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907-339-6500 Fax 907-339-5327
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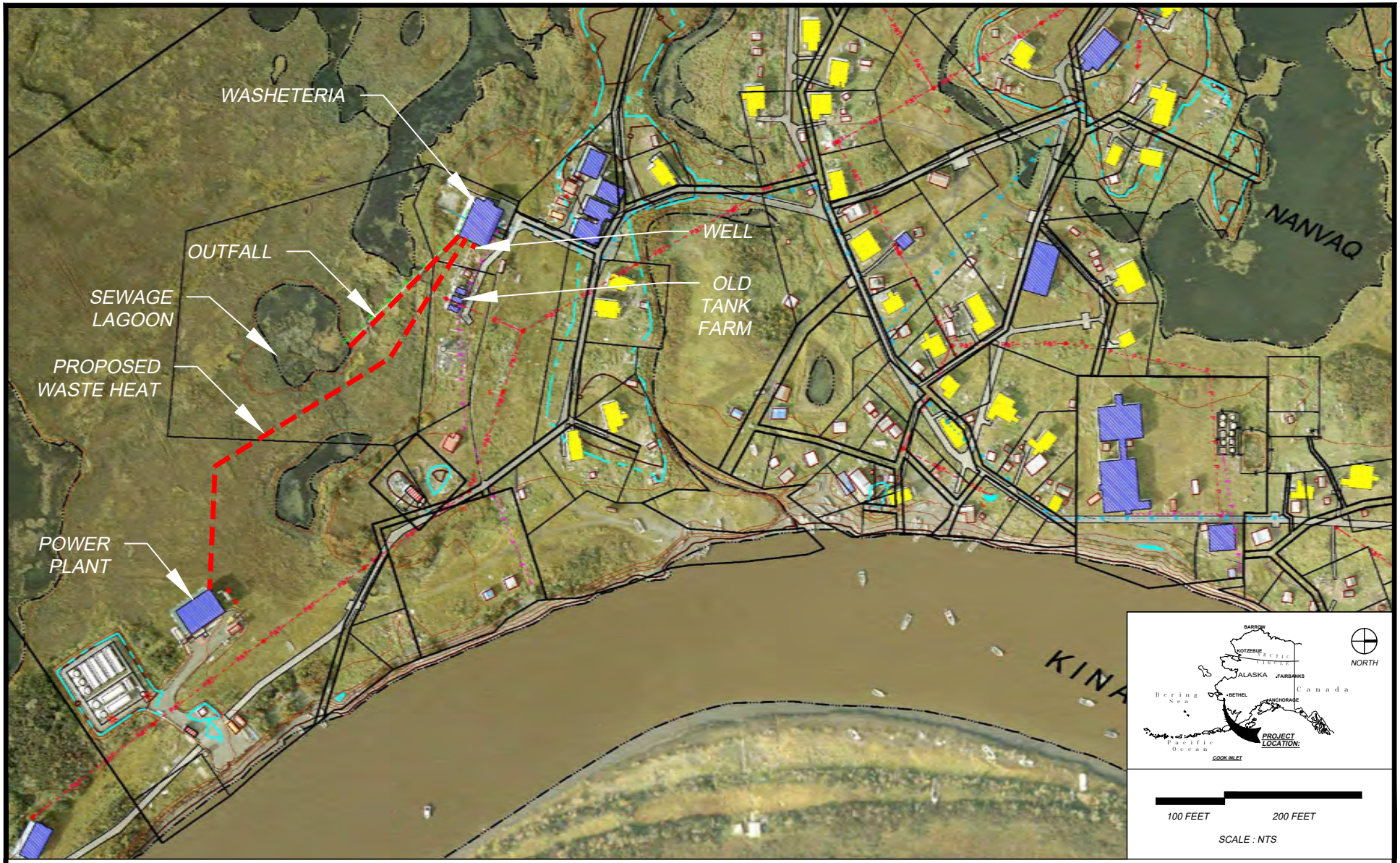
COMMUNITY MAP

A.1



WATER IMPROVEMENTS

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PROJ. NO.	165.030039
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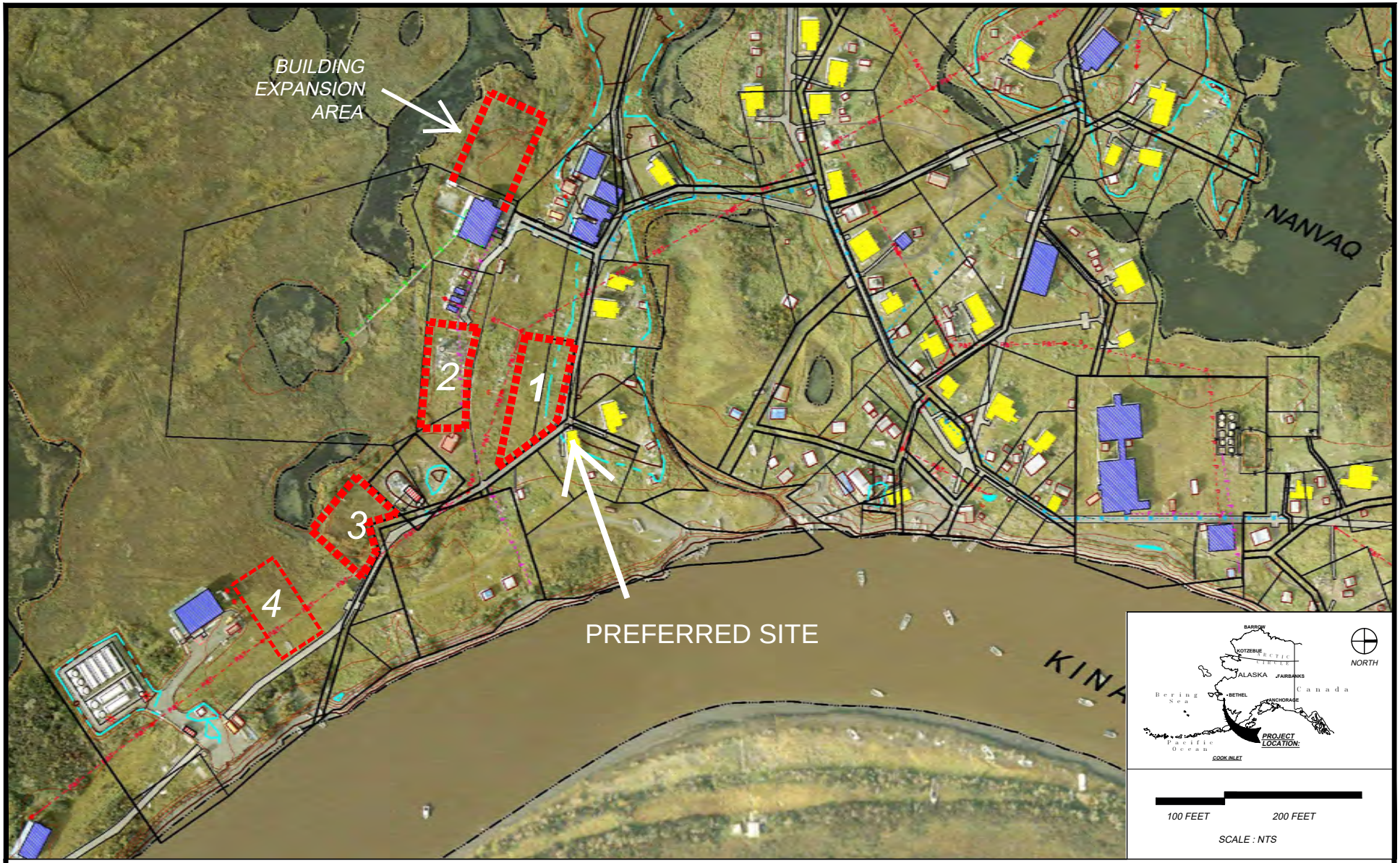
PROJECT AREA

A.2



WATER IMPROVEMENTS

TUNTUTULIAK, AK WATER IMPROVEMENTS
PRELIMINARY ENGINEERING REPORT

PROJ. NO.	165.030039
DRAWN	TRP
CHECKED	DEN
DATE	03/08/19

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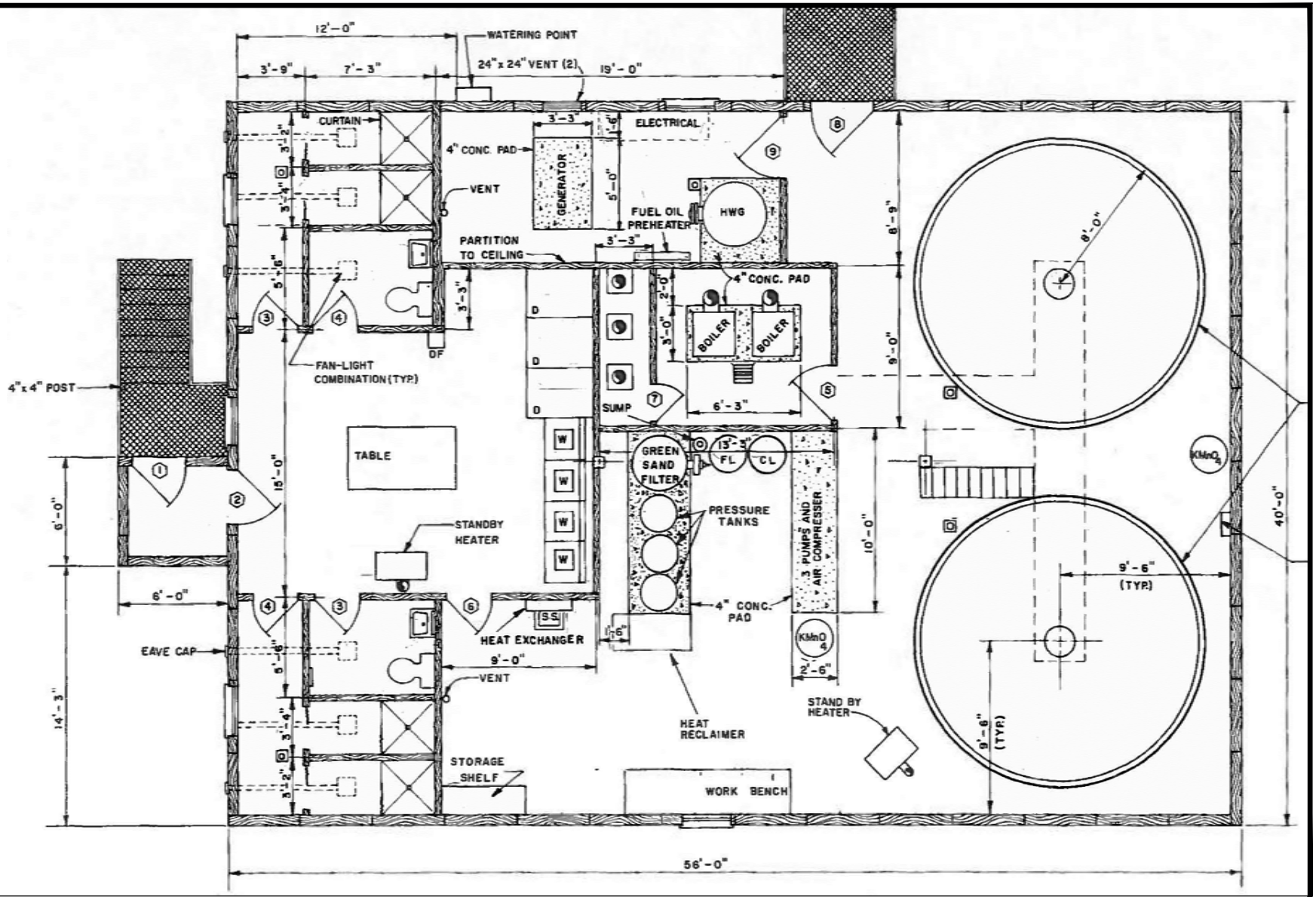
PROPOSED SITES

A.3



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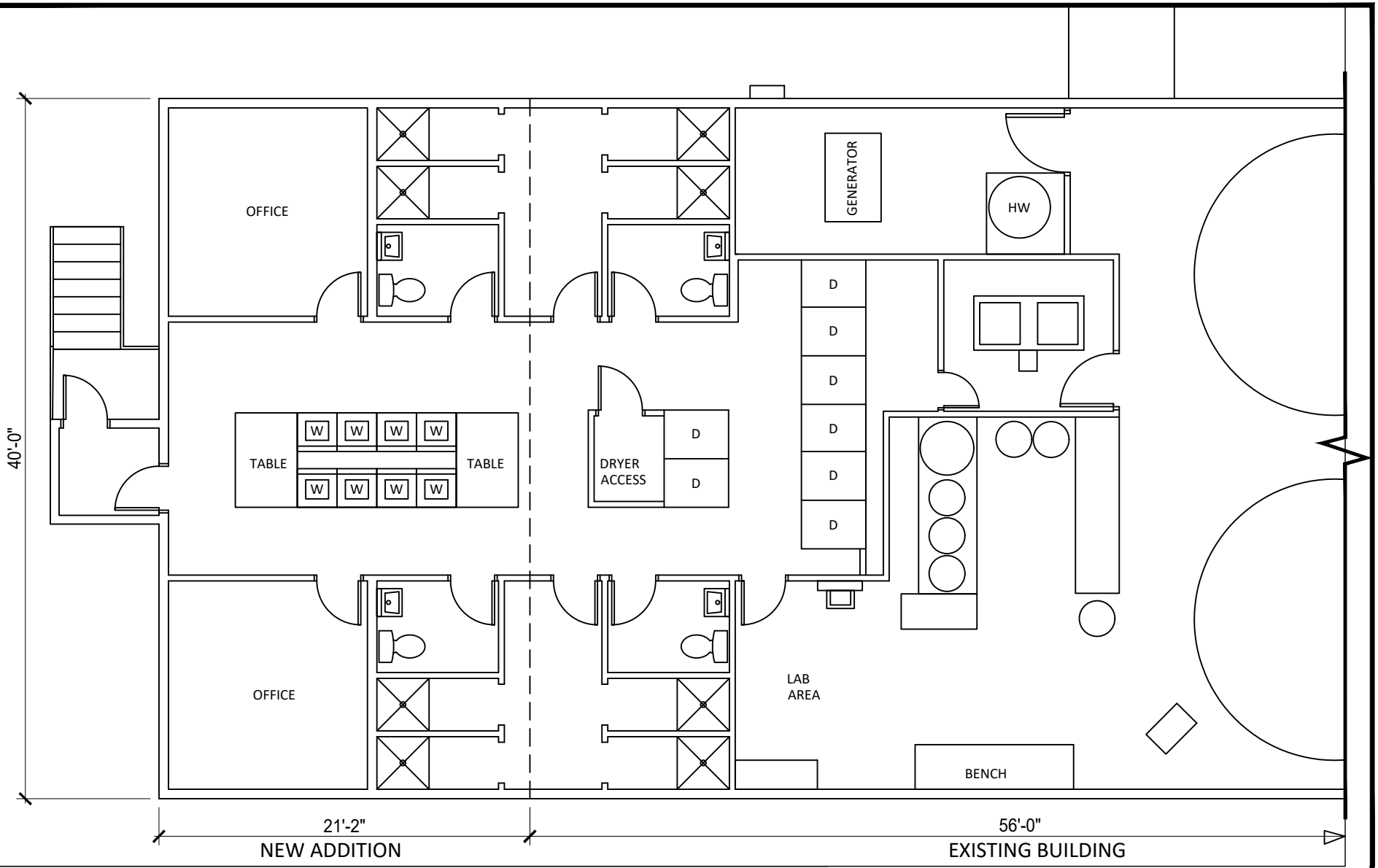
EXISTING FACILITY

A.4



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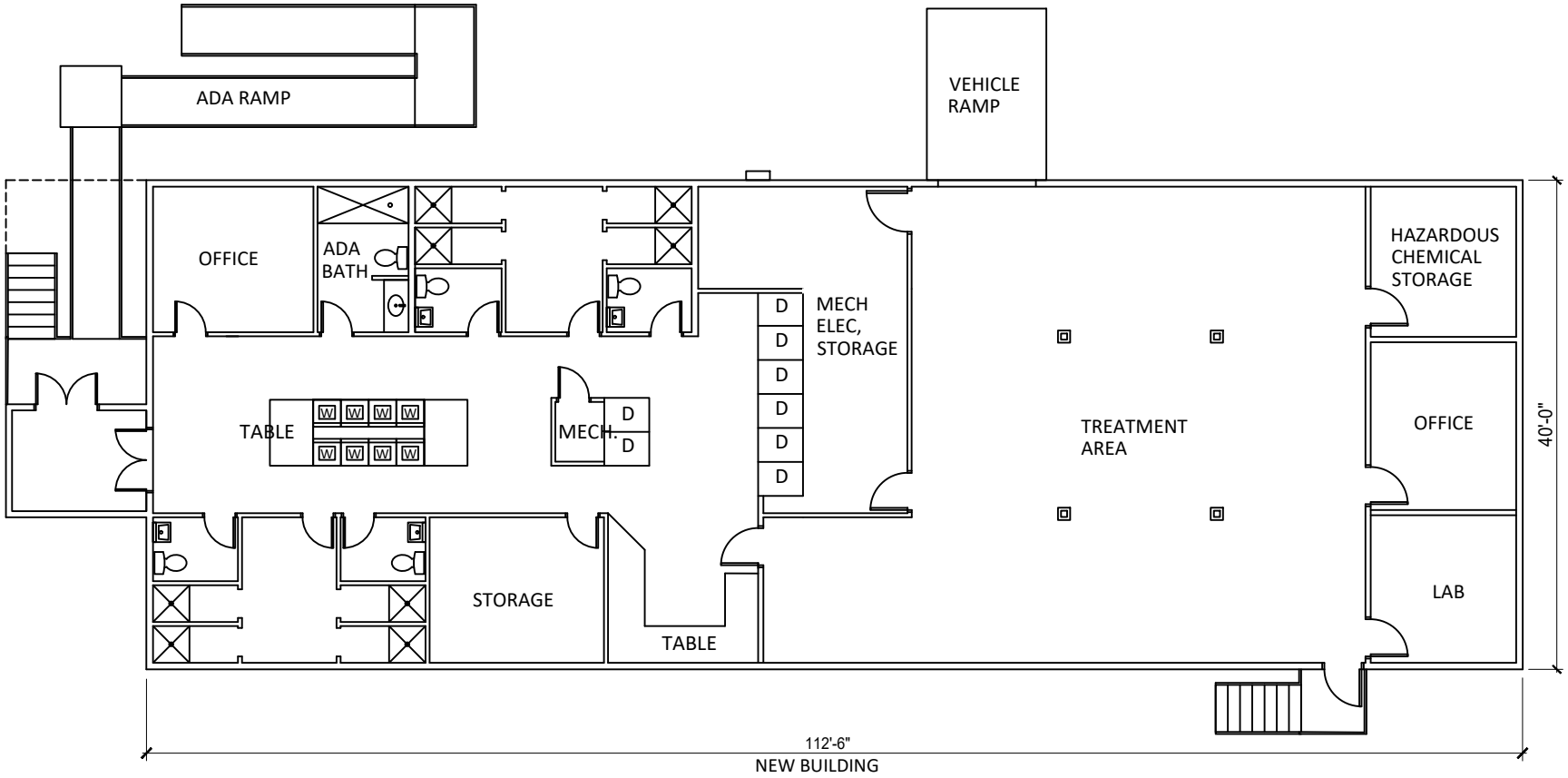
ALTERNATIVE 1

A.5



WATER IMPROVEMENTS

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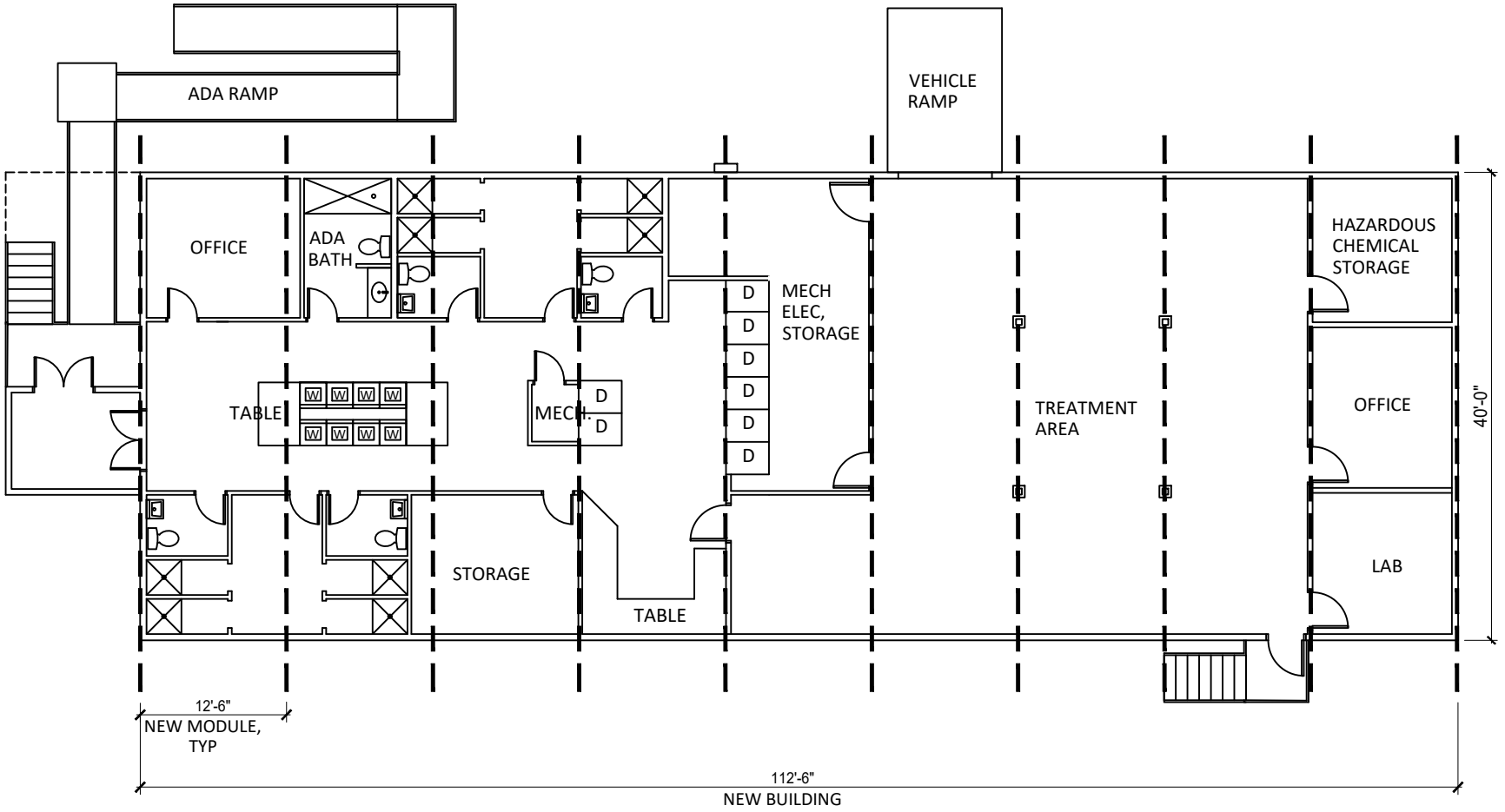
ALTERNATIVE 2
NEW STICK-BUILT

A.6



WATER IMPROVEMENTS

TUNTUTULIAK, AK WATER IMPROVEMENTS
PRELIMINARY ENGINEERING REPORT

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ALTERNATIVE 3
NEW MODULAR

A.7

Appendix B: Trip Reports and Photos

Contents:

- Tuntutuliak PER Trip Report (Kuna, August 2018)

TECHNICAL MEMORANDUM

Tuntutuliak PER Trip Report

Date: August 23, 2018 Project Number: 165.030039

To: Susan Randlett, Village Safe Water

From: Daniel Nichols, P.E.

INTRODUCTION

Kuna Engineering (Kuna) was hired by Village Safe Water (VSW) for the Tuntutuliak Washeteria Improvements PER. Daniel Nichols, project manager, traveled to Tuntutuliak on July 30, 2018. He was scheduled to return August 1, but was weather delayed until August 2.

Site Contacts:

- Deanna White, Tribal Administrator
- Andrea Johnson, Tribal Secretary
- Tom Charlie, AVCP, Tribal Workforce Development Specialist
- Tom Carl, Maintenance Supervisor
- Tom Friendly, Water Treatment Plant Operator
- Kabel Kusayak, Health Clinic Office Assistant
- Sherileen Frank, Community Health Aide
- Carl Andrew, TCSA Electrical Services, General Manager
- Peter Miely, Tribal Council Member
- Frank Lupie, Tribal Council Member
- John Fitka, Tribal Council Secretary
- Alice Fitka, Tribal Council Vice President

SCHEDULE

Monday, July 30, 2018

I left Anchorage at 6 am and arrived in Tuntutuliak at 2 pm. The Grant flight from Bethel to Tuntutuliak was delayed approximately an hour. I briefly met with Deanna White and Andrea Johnson and went over the trip goals and schedule. At 3 pm, I met up with Tom Carl and headed to the water treatment plant (WTP) and met with Tom Friendly. We toured the WTP and washeteria until 5 pm. That evening I walked the community documenting boardroads and facilities. I stayed at the tribal office.

Tuesday, July 31, 2018

8:30 am talked with Tom Charlie at the tribal office about barge operations, upcoming school projects, and local skills and workforce. 9:00 am, Tom Carl and I toured the honey bucket bunkers around the community. We visited 28 sites, many with multiple bunkers. Observations and discussion can be found in the *Honey Bucket Bunker Closure Recommendations* technical memo. 12:00 pm, I toured the washeteria documenting existing conditions. 1:00 pm, Tom Carl and I toured a variety of water and sewer holding tanks in the community. Observations and discussion can be found in the *Holding Tank Recommendations* technical memo. 3:00 pm, I met with the tribal council. I presented the project, its goals, and the outlined schedule. We discussed a wide variety of issues related to the three projects. 4:30 pm, Tom Carl and I toured the landfill and the sewage lagoon. 5:30 pm, I met with Andrea and collected information on washeteria usage and fees. 6:20 pm, I went back to the washeteria and WTP. I talked with the laundromat attendant about operations, usage, conditions, and costs. 7:00 pm, I gathered additional general community information, particularly on the condition of the boardroads.

Wednesday, August 1, 2018

8:00 am, worked in the tribal office and reviewed photos and information collected. 10:00 am, Tom Carl and I went to the clinic, at the suggestion of the tribal council. I met with Kabel and Sherileen and discussed community health as it related to sanitation. 11:00 am, Tom Carl and I returned to the WTP. I talked to Tom Friendly and observed treatment operations. 12:30 pm, reviewed WTP drawings and design information at the tribal office. 1:10 pm, I called Susan Randlett and discussed the project and trip. 1:30 pm, Tom Carl and I went to the village corporation office. I talked with Carl Andrew. We discussed the power utility an ANTHC waste heat project. 2:30 pm, I toured the old airport and barge areas. I looked at potential material sources and staging areas. 3:20 pm, we went back to the WTP to collect additional information. That afternoon my flight to Bethel was cancelled due to weather. 6:20 pm, visited potential sites for a new washeteria.

Thursday, August 2, 2018

7:30 am, I worked at the tribal office reviewing trip notes and photos waiting for change in weather. 2:30 pm, I was able to reschedule a flight to Bethel with Yute Air. I left Bethel at 9:00 pm and landed in Anchorage at 10:00 am.

OBSERVATION AND DISCUSSIONS

The following information was collected through direct observations or discussions.

Washeteria

- Women's bathroom is in use, but only one out of two showers is operational.
- Men's bathroom and shower room are not in use. The council reports they haven't worked since before 2013. They are now used as storage. Tom was unsure what is wrong but knows that they have attempted to repair them several times.
- Women's bathroom is distressed with broken mirror and vanity. There have been several holes patched in the walls. The door is damaged.

- The women's shower area has only one fan working and the other needs to be replaced; water-damaged floor and baseboards; inoperable window; mold in showers; leaking shower heads; signs of corrosion, etc.
- The floor throughout the washeteria needs to be replaced. In several places the floor is worn down to structural floor boards.
- It is recommended that the entire washeteria interior needs to be replaced (e.g. windows, flooring, sheetrock, shower, bathrooms, etc.).
- There are two septic tanks used only for black water attached to the bottom of the building. All grey water is discharged to the tundra roughly north of the washeteria
- Drinking fountain doesn't work.
- The men's bathroom holding tank is not being used. The women's bathroom holding tank freezes occasionally during the winter.
- Emergency lights and smoke detectors don't work and have expired. The fire extinguisher has expired and needs to be recharged.
- The phone jacks and outlets are broken.
- Pile foundation appears stable with minimal movement. There is approximately 1/8 inch of corrosion loss and scaling around northern half of the piles. Design drawings show 5/8-inch thick piles. Many of the thermal couplings are damaged. Some were broken open, which releases any refrigerant.
- Approximately 4-6 feet of blow through under building.
- Tribal secretary keeps track of laundromat and shower usage. She reports that only about one person pays for the shower each week. Most people don't like the shower conditions. She confirmed that most people use steam baths. She reports about 10-15 people a day use the laundromat and there is a waiting list.
- The washeteria is open from 10 am to 9 pm every day except Sunday. They have to staff it in at least two shifts. The community would have to hire more staff to keep the washeteria open longer. Clinic and community stores don't open until 10 am. Community curfew is 10 pm.
- It is $5 to use a shower. A washer load costs $5 and a dryer load costs $7.
- There are four washers. The washers are filled up manually from a hose. Couldn't determine what was wrong with the piping to the washers. Washeteria staff and Tom Friendly didn't know why.
- Laundry staff confirms issue with washers staining cloths red and water turning black when bleach is added. Those are signs of high iron or oxidation in pipes.
- There are four dryers; two larger and two smaller. Only two dryers currently work. A new one has arrived but has not been installed yet.
- There is only one small table and no room to fold laundry. People reportedly don't use the dryers because of the lack of space. There is also very limited space to wait for laundry.
- Floor louvers for dryer vents are not operable. It appears dryers are sucking their intake air from the building.
- There is no ventilation in the washeteria. The doors have to be propped open.
- Only one of three exterior lights works.
- No GFCI outlets or breakers in washeteria.
- Observation: laundromat was always in use when I visited. After 5 PM it was very crowded.

Water Treatment Plant

- Tom Friendly is the operator. He started working in November 2017.
- Washeteria has two watering points; two-inch hose for community hauling and self-haul station. The self-haul station has been down for repairs since January. The parts are on order but have not arrived. It is reported it is down due to failing a test.
- Watering fee is $50 for 150 gallons with community-haul and $0.25 per gallon with self-haul.
- Until a couple of years ago, they used potassium permanganate, fluoride, and chlorine treatment. Only potassium permanganate is still being used.
- Tom reports he treats raw water approximately every other day. He treats water 2-4 hours a day. It takes 3-4 days to drain the water storage tank.
- Emergency lights and smoke detectors don't work and have expired. The fire extinguisher has expired and needs to be recharged.
- Eye wash station and hazardous materials and SPCC signage were observed.
- Back scour is done after every treatment. Uses approximately 500-1,000 gallons for 10 minutes. The air scour isn't used because it was installed without a filter and is clogged. Tom hasn't been able to unclog it.
- A pile of GAC bags was found in the loft area. Tom unsure if the filter medium has ever been changed.
- One foot of tank volume equals 1,250 gallons. In one day the water level dropped 0.3 feet or 375 gallons.
- Older boiler used to leak 5 gallons of glycol a day until fixed recently. It still leaks a little.
- Numerous small leaks on valves, gauges, pumps, and pipes were seen. Tom regularly has to inspect and tighten or repair them. Small leaks noticed on piping and valves throughout.
- Valves regularly fail. Last week valve broke and flooded part of the floor. Tom says he replaces a valve at least once a month.
- Water pressure pumps operate at 32-42 psi.
- Lift station in WTP works but there is no vent on the lift station, only upstream on the inflow pipe. There is a strong sewage smell in the WTP coming from lift station. It doesn't appear to be properly ventilated. Lift station and holding tank were cleaned recently but that doesn't seem to improve the smell.
- There is no ventilation in the WTP. They have to open windows and door to get fresh air.
- Tom Friendly is unsure if backup generators work or have been tested. They appear to be unused but appearances are not reliable.
- Raw water storage tank level gauge doesn't work. Tom has to look through top hatch to estimate water level.
- Piping throughout has been replaced with Plex-style piping. Some of it is inadequately supported and water hammering was observed.
- No office space in the WTP for the operators or storing records.
- No GFCI outlets or breakers in WTP.
- Backwash outfall was recently replaced. Not sure of year. The outfall has already started to sag and move. I was unable to walk outfall because of standing water.
- Iron test results for the treated water range from 0.0 to 0.3 mg/l. This doesn't match with taste and reported laundry problems.
- Tom didn't have arsenic or lead results. Not sure if it was out of compliance.

Water and Sewage

- No one is currently using the washeteria for drinking water. Only the community hall and clinic haul water for grey water.
- It is reported that everyone in the community uses rainwater and snow/ice melt for drinking water. Several people reported using river water for washing clothes.
- This year has been rainy, so people have not run out of drinking water. When they do, they haul river water. Typically, May and June are the driest months. People typically run out of rainwater in the end of June, until early July when it starts to rain again.
- Newer homes have septic holding tanks and the community pumps them once a week.
- Many residents use honey buckets which are dumped into hoppers located around the community.
- Many of the other homes have had problems with freezing septic tanks.
- 28 bunker sites were counted spread throughout the community. Most are abandoned but several show signs of recently being used. Many show signs of damage due to heaving, settling, and rotting. At least four had the wooden tops collapse inward. There is a current project to close several of the bunkers permanently.
- Sewage lagoon is located adjacent to the landfill. The boardroad and dumping platform were burned in a landfill fire. Sewage appears to be dumped in multiple areas along the lagoon because of the access issues.

Council Meeting Summary

- The Council wants to incorporate waste heat into the washeteria.
- USS No. 4429, Block 15, Lots 1, 2, and 3 are controlled by the village. It is their preferred sited for a new washeteria.
- They recommended against the old power plant site next to the washeteria because of ongoing ADEC fuel cleanup for 1980 spill.
- They report that the washeteria area never floods and confirmed the pile foundation is stable.
- In 2012, the washeteria froze because it ran out of heating fuel. The pipes burst causing lots of damage.
- They prefer stick-built construction over modular because of increase in local hire. They recently had several residents get trained as welders. They believe there are a lot of skilled construction workers in the community.
- There are too few washers and dryers. Most days there is a waiting list and some days people have to wait until another day to use the laundry mat. They believe at least 8 washers and dryers are needed.
- They confirmed that most people stopped using the washeteria for drinking water after the self-haul station got contaminated.
- They confirmed that replacing the washeteria is their highest priority.
- They are concerned with safety of the washeteria because of extensive electrical and plumbing code issues.
- They report the piping is so old at the washeteria that they get black water out of it sometimes. They believe it is due to corrosion in the pipes.
- They want to close out and clean up the honey bucket bunkers. They are concerned about the health and safety issues caused by the bunkers.

- Confirmed the school project and the contractor's staging plans.
- They prefer the insulated steel tank septic holding tanks over the other styles in the community. They recommend stainless steel connections and two heat traces.
- They report that not many people use shower. Most use traditional steam baths. Some families don't have steam baths and have to use neighbors' or family members'.
- School has better water and better laundry facilities. Community washers stain cloths red. Alice works at the school and uses their laundry whenever she can because of the better quality water.
- They report complaints about the smell of the water at the washeteria.
- They report that skin disease and boils are common in the community with some cases needing to be sent out of community for treatment. They directed me to talk to the clinic for more details.
- Alice reports that children come to school dirty because of a lack of showers and/or steam baths.
- Alice described her water uses. She uses water from the river and pumps it to a 50 gallon drum. She uses it for washing and cleaning. She uses rainwater for drinking and cooking.

Potential Sites

- Checked out four sites; site west of washeteria, site across of washeteria, site west of United Utility communication tower, and area around power plant.
- Each site was within a reasonable distance from the power plant for waste heat.
- According to the community maps, each site is on village land.
- Site west of washeteria is on old power plant site (USS No. 4429, Tract A, Block 15, Lot 5. There is a known spill from the 1980s that ADEC is in the process of cleaning up. Area very wet with areas of standing water.
- Site across from washeteria is on USS No. 4429, Tract A, Block 15, Lots 1, 2, and 3. East half of Lot 3 is wet and marshy. Lot 1 and 2 are higher and have dry ground. The community map show them outside of the high water flood area. Site has straight shot to the sewage stabilization pond for discharge.
- Site west of United Utility (USS No. 4429, Tract A, Block 14). This area is drier and higher than surrounding areas. The drier area is adjacent to satellite dish. A new washeteria would block satellite dish which would have to be relocated. There is a small pond between the sewage stabilization pond and the site. A new outfall would have to go over the pond or get a new permit to discharge into the pond.
- Site around the power plant is all on USS No. 4429, Tract A, Block 14. The power plant does not have a specific plot and is just part of the large Block. The area around the power plant is the lowest; at least 4 feet lower than the existing washeteria site. There is a noticeable drainage channel through the area. There was standing water throughout the area in patches. It is reported that at extreme high tides, the area floods.

General Community Information

- Most barges unload at the south end of the old airstrip. The airstrip is mainly used as a laydown area for construction projects and other barge activities. The old airstrip appears to be constructed of silty sands and gravels with approximately 1 foot of surface gravel. About half of the airstrip width is

covered with brush. The surface is becoming rutty and would need to be regraded if the area were to be used by heavy equipment. There is some erosion along the south end of the airstrip.

- There is a barge landing at the fuel farm but it is mainly used for fuel barges. There are barge tie offs.
- Sometimes barges have landed at the north end of the old airstrip.
- The school is schedule for a major remodeling and expansion. A contractor is already under contract and will begin hauling materials and equipment this year. It is reported that the contractor will stage at the airstrip, then move to the school site once the ground has frozen.
- Flood gauge was destroyed when the utility pole it was attached to was moved.
- Boardroad conditions vary. Many sections are warped, frost jacked, or sunken. Many sections and bridges are floating at ground level with large foam-filled sleepers. Several have been pulled off piles or damaged anchors. Tom Carl reports that large vehicles can damage the boardroads.
- There is active erosion along the boat launch areas by the school. There are several homes being threatened and a boardroad undermined by the erosion. The boat area down river along the east side of town also has active erosion.
- Met with Carl Andrews with the utility. They still want to move forward with providing waste heat to the existing or new washeteria. They will provide the waste heat free of charge to the community. The project was designed by ANTHC but doesn't have enough money for construction. Design drawings didn't include land ownership information, though land between power plant and washeteria seems to be owned by the village. We discussed potential of using utility easement for any waste heat.
- Carl reports that school project will make improvements to the power plant.
- Carl also reports that office ATCO modules from early 1990s are doing well but starting to be drafty around joints.
- Clinic confirmed they have 1-2 cases a week of boils or skin infections that require treatment.

Miscellaneous

- Honey bucket bunkers and tank observations and discussions were part of another project and are covered in separate technical memos.

DRAFT PER ALTERNATIVES

Below is the list of alternatives to be considered:

1. No change

This alternative is required by funding agency. This alternative would not provide any improvements or replacement. The washeteria is not meeting the demands and needs of the community. This is, in part, because of facility deterioration, undersized laundry, water quality, and watering point contamination. As a result the residents are using untreated drinking water. Due to a lack of access to quality water, there has been a decrease in hygiene which results in community having a very high rate of boils and skin diseases. This alternative is not a feasible option.

2. Individual Onsite Septic and Well Systems

It is standard to evaluate alternatives to provide typical onsite septic and well systems. This alternative has been evaluated in the past and found not feasible. Due to poor soils, flooding, and high groundwater, septic system are not feasible. Due to groundwater quality and poor soils individual wells are not feasible. Most house lots are too small to accommodate onsite systems. This alternative is not feasible.

3. Alternative In-home Sanitation Systems

This alternative would provide alternative in-home water and sewer systems. This alternative will focus on the Kivalina pilot program done by ANTHC. This system combines rain catchment and micro water treatment systems with grey water and separation toilets. In the past, alternative systems have not been feasible sometime because of high homeowner costs and sometimes issues with reliability. This alternative has potential due to the residents' familiarity with rainwater use. One disadvantage is the lack of snow melt capacity. It is also likely that a washeteria would still be necessary and thus need improvements.

4. Remodel and Expand Washeteria

This alternative would include major improvements to the washeteria. This would include a complete remodel of the interior. It would also expand the laundry and add office space for both the washeteria manager and water treatment operator. The WTP lift station would need to be improved or replaced. There would also need to be improvements to the water treatment side, such as pipe replacement, ventilation, and iron removal. The whole building would need to be brought up to fire, safety, electrical, and plumbing codes.

5. New Modular Washeteria

This alternative would replace the existing washeteria and WTP with a new modular facility. There would be a discussion on location alternatives, but would focus on the preferred site across from the existing washeteria. The well and sewage stabilization pond would continue to be used. The overall size of the facility would increase as well as the drinking water storage capacity. Water storage capacity would likely need to increase because of increased water use due to improved facilities.

6. New Stick-Built Washeteria

This alternative would be the same as Alternative 5, but would evaluate stick-built instead of modular built. The main difference would be cost estimate.

Note: Piped community water and sewer is not part of this PER's scope. In 2016, a report looked at installing a piped community system. The cost for the construction was $53 million, approximately $132,500 per resident with annual O&M costs of $441,000. This is currently not a feasible alternative.

ATTACHMENTS

- Trip Photos
- Tribal Council Meeting Minutes

Figure 1: Washeteria

Figure 2: Water Treatment Plant (WTP)-Interior

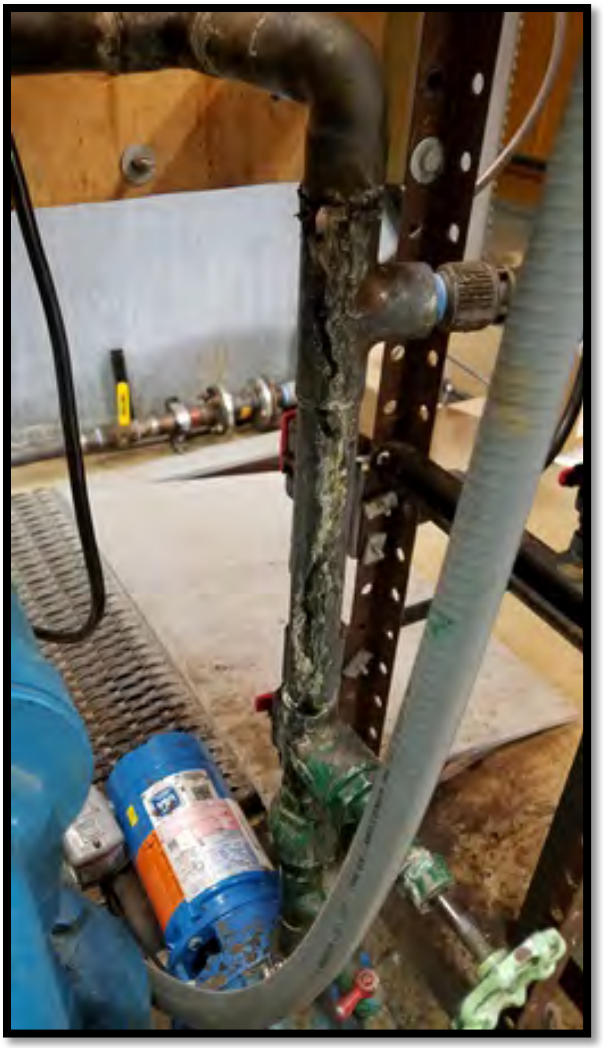

Figure 3 (left): Leaking pressure pump.
Figure 4 (right): Pile corrosion.

Figure 5: WTP work bench and record library.

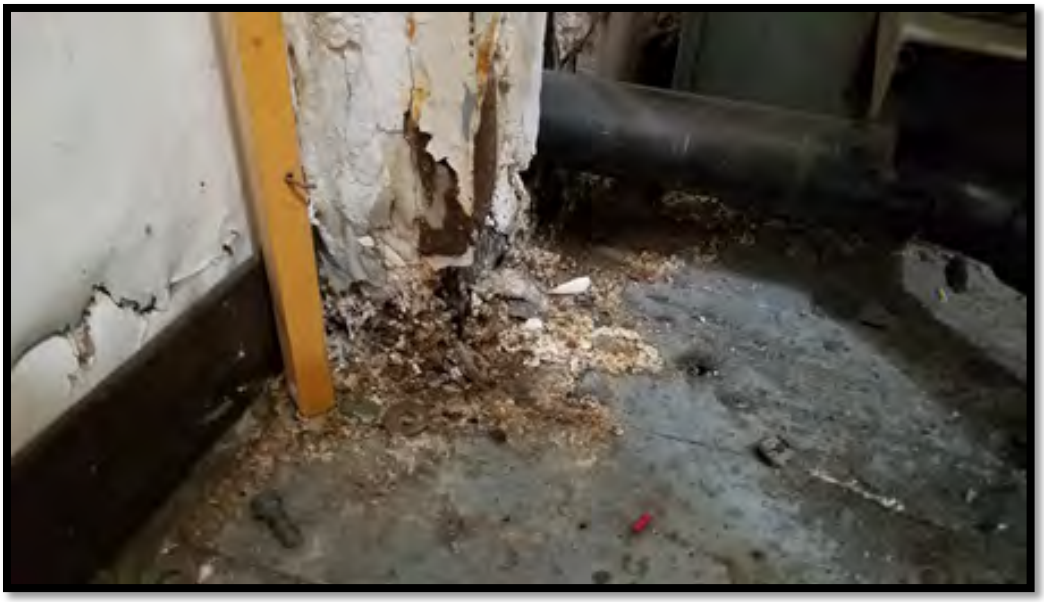

Figure 6: Water damage behind dryers in washeteria

Figure 7: Dryers and folding table

Figure 8: Washer, manual filling with hose.

Figure 9: Women's only operable shower.

Figure 10: Women's shower, water damage and mold.

Figure 11: Women's shower, water damage along wall and floor.

Figure 12: Village corporation office, modular construction.

Figure 13: Typical boardroad

Figure 14: Typical boardroad, floating on tundra and marshy area

Figure 15: Basketball court, damaged from heavying and settling.

Figure 16: Barge landing, east end of old airstrip.

Figure 17: Old airstrip, laydown area and potential material site.

Figure 18: Rainwater collection system

Figure 19: Rainwater collection system.

Figure 20: Power Plant

Figure 21: Potential new washeteria site by power plant, standing water

Figure 22: Potential new washeteria site by power plant, looking towards the current washeteria.

Figure 23: Potential new washeteria site by United Utility, looking east.

Figure 24: Potential new washeteria site by United Utility, looking west towards power plant.

Figure 25: Potential new washeteria site across existing washeteria, looking north east at washeteria.

Figure 26: Potential new washeteria site across existing washeteria, looking south from washeteria.

Figure 26: Potential new washeteria site across existing washeteria, looking north at washeteria.

Telephone / Meeting Conversation

3:00-4:30PM

Project No.: _____ Date: 7/31/2018 By: DEN

Project Name: TUNTUTULIAK WASHETERIA & WTP PER

To/From:	Subject: VSW PER INTRODUCTION &
With:	
Location: TRIBAL OFFICE	Present:
Purpose:	

- ○ Memo
- ○ Telephone Conversation
- ○ Site Visit Notes
- ☒ Meeting Notes

Notes: SIGN IN SHEET

NAME	TITLE	PHONE NUMBER
Peter Miller	Council Member	256 2981
Frank Lupie	Council Member	312-9673
JOHN FITKA	Council Sec	256-6970
Alice Fitka	Vice President-TTC	256-6147
Deanne White	Tribal Administrator	

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Appendix C: Supporting Reports

Contents:

- Water Treatment Plant Technical Memo (CRW, May 2011)
- Tuntutuliak, Alaska Heat Recovery Study (ANTHC, June 2013)
- Quarterly Report 2014, Tuntutuliak (RUBA, 2014)
- Best Practice Score, Tuntutuliak (RUBA, Fall 2018)

MEMORANDUM

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Project: Tuntutuliak Water Treatment Plan Improvements (81801.00, Task 030)

Date: May 12, 2011

Subject: Water Treatment Plant Technical Memorandum

By: Trevor Trasky, EIT

Introduction

The existing water treatment plant (WTP) in Tuntutuliak, Alaska is in need of upgrades to provide improved water treatment. The facility does not meet current drinking water standards due to deficiencies in the system. Treated water currently exceeds the secondary standards for iron and manganese. Proposed upgrades to address these deficiencies are listed below along with estimated costs for materials, labor, and freight required for installation.

Existing Water Treatment Description

Groundwater supplied from a well located adjacent to the WTP is piped to the water treatment system that provides batch treatment on an as-needed basis. Water from the well is injected with potassium permanganate before flowing into a 10,000-gallon pretreatment tank where oxidation and settling occur. The oxidized water is then pumped from the pretreatment tank through a 30-inch diameter greensand pressure filter and disinfected before entering a 10,000-gallon water storage tank. Pressure pumps and hydropneumatic tanks serve a watering point, washeteria, and flush tank and haul service.

Deficiencies in the existing process include the watering point, well discharge piping, pretreatment system, potassium permanganate feed system, and greensand filter. The watering point has poor accessibility for vehicle haul and does not prevent excessive wasting of water. The well head, the piping from the well to the WTP, and the connection to the WTP are not sufficiently insulated and supported. The pretreatment tank piping configuration draws water from the bottom of the pretreatment tank which may contain oxidized sludge. The potassium permanganate feed system does not achieve uniform oxidant injection into the raw water. The greensand filter is not configured for proper air scour. No turbidimeters are present. These deficiencies decrease the efficiency and stability of the treatment process and results in poor finished water quality that is undesirable for use by the community.

Water Sample Analysis

Water samples were taken from Tuntutuliak during CRW site visits in December 2010 and March 2011. The data from these samples as well as a historical sample pertinent to the process design for the upgraded WTP are show below in Table 1. Raw water arsenic levels are higher than the maximum contaminant level (MCL) and levels for iron and manganese are above their respective secondary standards as well. Total organic carbon (TOC) levels in the raw water are high enough to warrant removal to minimize DBP formation.

The laboratory results of the water samples collected by CRW are provided in Appendix A. Historical water samples results reported to ADEC are also included.

Table 1 - Tuntutuliak Water Samples

		Analysis Performed by		SGS	SGS	SGS	CT&E Environmental Services
		Lab Sample No.		1110756	1106624	1106624	1027368001
		Sampling Date		3/2/2011	12/15/2010	12/15/2010	10/29/2002
		Sample Description		Tuntutuliak Raw	Tuntutuliak Raw	Tuntutuliak Treated	Tuntutuliak 1
Contaminant	Units	MRL[1]	MCL	Result	Result	Result	Result
Iron	mg/L	0.05	0.3	**18.50**	**4.78**	**0.49**	**5.02**
Manganese	mg/L	0.01	0.05	**0.18**	**0.09**	**1.18**	**0.09**
Arsenic	ug/L	0.15	10	**13.50**			**37.40**
Hardness, Total	mg/L	1		206.00	206.00	207.00	-
Alkalinity, Total	mg/L as $CaCO_3$	4		237.00	-	-	-
pH	pH	0		-	-	-	7.10
Total Dissolved Solids	mg/L	20	500	301.00	-	-	299.00
Total Organic Carbon	mg/L	1		12.20	-	-	11.70
Dissolved Organic Carbon	mg/L	1		9.11	-	-	-
UV 254 Ultraviolet	cm-1	0.02		0.27	-	-	-
Lead	ug/l	0.2	15	9.38	-	-	-

1. MRL – Method Reporting Limit

Proposed Upgrades

The proposed upgrades were selected for their ability to address the treatment deficiencies and provide treated water that complies with applicable drinking water standards. A process flow diagram that incorporates the proposed upgrades is located in Appendix B.

Proposed system upgrades include:

- Watering Point Upgrades
- Well System Upgrades
- Pretreatment Upgrades
- New Potassium Permanganate Chemical Feed System
- New Greensand Filtration Unit with Turbidimeters
- New Air Scour Unit
- Granular Activated Carbon Filtration Unit
- Polymer Injection System

Watering Point

The existing watering point is manually operated using a button-activated solenoid valve in the WTP. The existing watering point control is not working. This configuration does not prevent excessive waste of water nor does it allow for revenue to be collected for water. The watering point does not extend out from the building and does not currently have a flexible hose for the discharge, making it difficult to fill containers on a vehicle. Upgrades are proposed to add a coin operated solenoid to allow revenue collection and prevent excessive wasting of water at the watering point. Watering point piping should also be upgraded by installing an insulated arctic pipe arm with a flexible hose drop pipe to improve accessibility for vehicle haul. This alternative is itemized in Table 2. Due to budget considerations, a second alternative including only the addition of a coin operated dispensing system is presented in Table 3.

Figure 1 - Public Watering Point

Figure 2 - Public Watering Point Piping and Actuator

Table 2 – Comprehensive Watering Point Improvements

Component	Manufacturer	Model	Estimated Cost
Coin-op	Monarch	HM6	$1,000
Piping	N/A	N/A	$2,000
Labor			$4,500
		Total:	**$7,500**

Table 3 – Watering Point Coin-op

Component	Manufacturer	Model	Estimated Cost
Coin-op	Monarch	HM6	$1,000
Labor			$2,000
		Total:	**$3,000**

Well System Upgrades

The arctic box on the well head is in need of replacement as it offers minimal thermal protection. The existing transmission line from the well is an approximately 20-foot long copper pipe equipped with heat trace inside an arctic insulated PVC pipe with a CMP jacket. This pipe was supported with 3-legged wooden assemblies with cradles. The supports are now in a state of disrepair, leaving the pipe rigidly supported only at the well end. This also places a strain on the rigid copper water piping. The arctic box at the connection of the raw water pipe to the WTP is partially disassembled resulting in the potential for damage due to freezing. Also, water in the raw water line is forced back into the well using compressed air after the well pump is turned off. This process can be made automatic by installing an air/vacuum valve on the raw water piping in the WTP as record drawings indicate that bleeder valve is already present on the well drop pipe. An air/vacuum valve in the WTP, new arctic boxes at the well head and connection to the WTP, and a new raw water transmission line consisting of a 1-inch or 1.5-inch HDPE carrier pipe with arctic insulation supported by wood cribs are recommended to address these deficiencies.

Figure 3 - Well System and Transmission Line

Figure 4 - Well Head

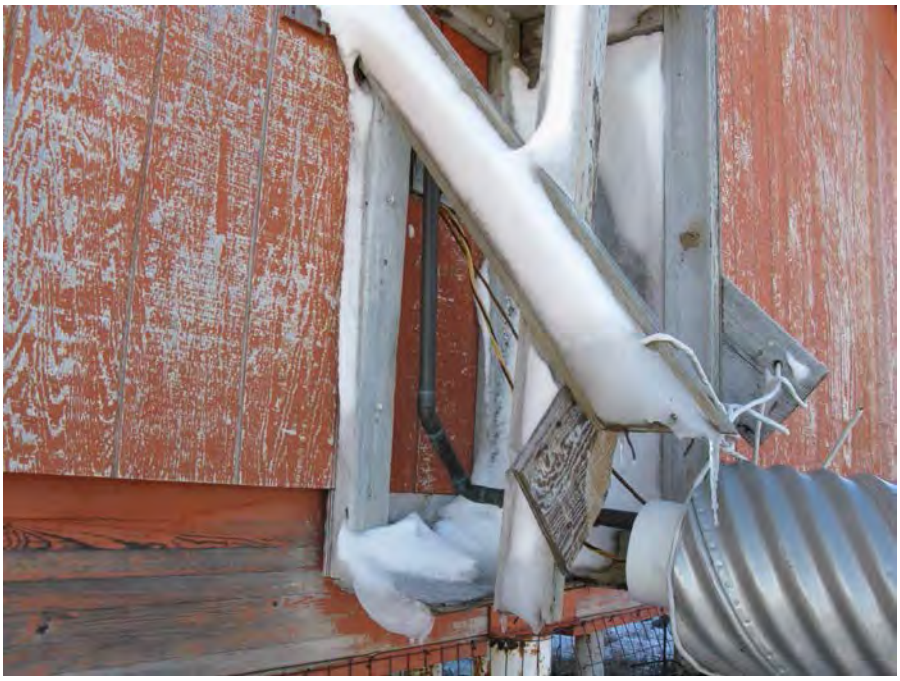


Figure 5 - Connection to WTP

Table 4 – Well System Upgrades

Component	Manufacturer	Model	Estimated Cost
Well Head Arctic Box	N/A	N/A	$1,000
Arctic Pipe	N/A	N/A	$2,000
Air/Vacuum Breaker	Cla-Val		$500
Building Tie-in	N/A	N/A	$500
Labor			$3,000
		Total:	**$7,000**

Pretreatment Upgrades

Pretreatment upgrades include a decanter for pumping supernatant from the settled water in the 10,000 gallon pretreatment tank, a mixer for the tank, and an aeration grid. The decanter allows for only the clear supernatant in the pretreatment tank to be filtered which increases filter run times and filtrate water quality. The decanter consists of a swivel arm at the base of a float-equipped pipe that allows the filter pumps to draw only the supernatant of the settled water.

The tank mixer allows for the oxidant-dosed water to mix completely in the pretreatment tank to aid in achieving total oxidation. The mixer operates while the pretreatment tank is being filled and continues to mix for 2 hours after the treatment tank is full.

An aeration grid should also be installed in the pretreatment tank for pH adjustment. Aeration with fine bubble diffusers strips dissolved CO_2 from the water. Dissolved CO_2 combines with water molecules to form carbonic acid. As dissolved CO_2 is removed the

concentration of carbonic acid decreases which increases the pH of the water. This increase in pH reduces the corrosivity of the water to lead and copper. Aeration should occur after oxidation in the pretreatment tank is complete based on past experience from the Napaskiak and Crooked Creek WTPs.

It will also be important that the pretreatment tank is drained almost completely prior to refilling to avoid floc settleability issues similar to those observed during Crooked Creek's previous pretreatment aeration. Examples of the proposed decanter system are shown in Figure 6 and 7 respectively. Drawings of the recommended pretreatment improvements are provided in Appendix D.

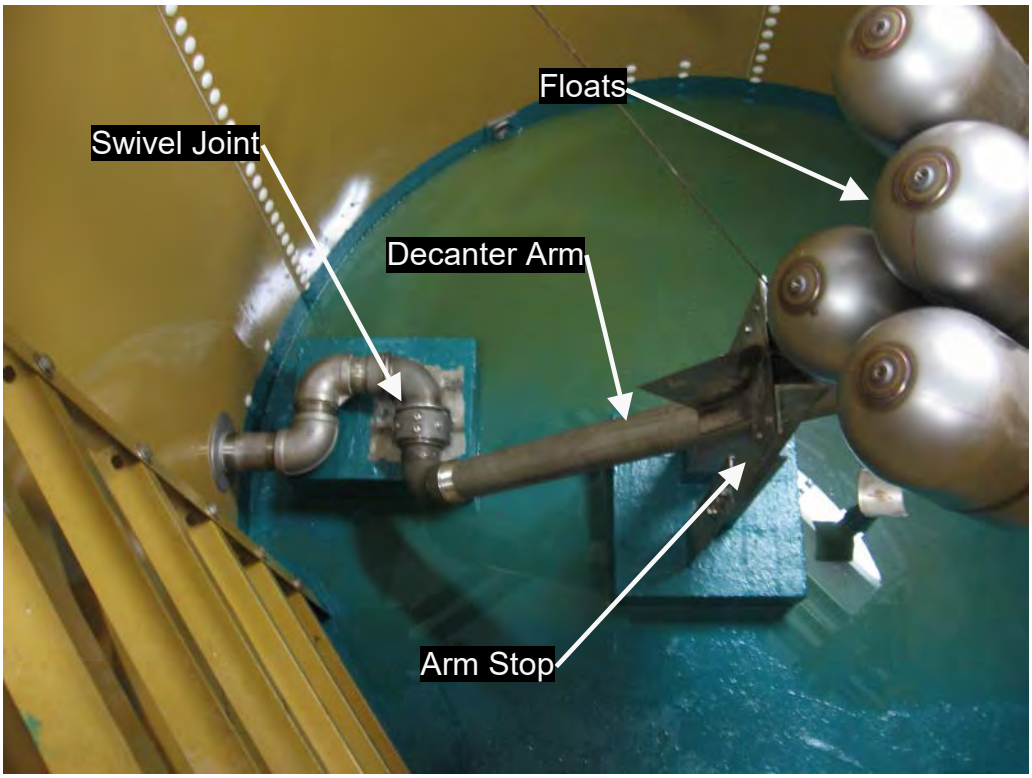


Figure 6 - Decanter Mechanism

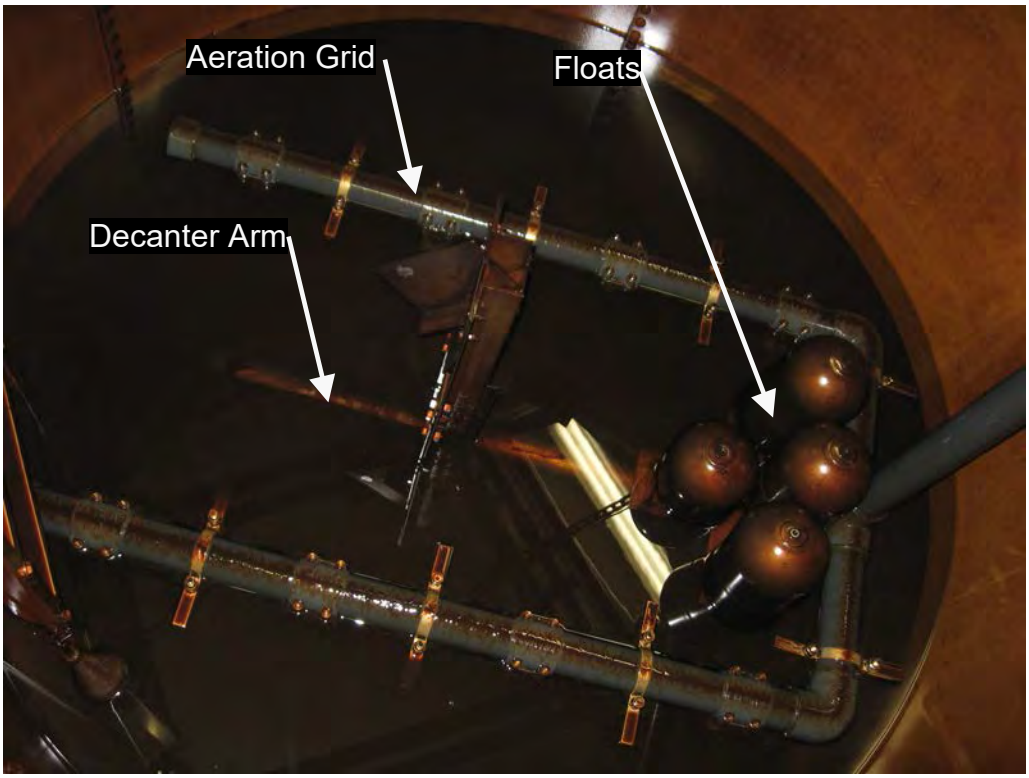


Figure 7 - Aeration Grid and Decanter Mechanism

Table 5 – Pretreatment Upgrades

Component	Manufacturer	Model	Estimated Cost
Supernatant Pumping Arm	N/A	N/A	$5,000
Tank Mixer	J.L. Wingert	WXL	$1,500
Aeration Grid	N/A	N/A	$4,000
Labor			$8,000
		Total:	**$18,500**

Potassium Permanganate Feed System

A new potassium permanganate ($KMnO_4$) feed system is recommended to provide optimum oxidation and removal of iron, manganese, and arsenic while also providing sufficient residual for continuous regeneration of the greensand media in the filter. An on-line oxidation/reduction potential (ORP) analyzer can be used to dose $KMnO_4$ at an optimal concentration based on the raw water characteristics. ORP is measured in millivolts (mV). A diaphragm pump can be used to inject the raw water with $KMnO_4$ just upstream of the pretreatment tank. The output of this pump should be controlled by the ORP analyzer and will be proportional to the overall state of oxidation in the pretreatment tank. The preferred ORP analyzer has 2 probes, one which will be located on the discharge side of a circulation pump that draws from the bottom of the pretreatment tank, and one just upstream of the filter.

A circulation pump is recommended to draw water from the bottom of the tank and discharge it just upstream of the $KMnO_4$ injection tee. This allows for the $KMnO_4$ dose to be adjusted based on water that has been allowed to oxidize. The first injection point is optimized for complete iron oxidation in the pretreatment tank. A second peristaltic pump injects an additional amount of $KMnO_4$ to provide a sufficient oxidant residual to the filters for greensand media regeneration. The second injection point is optimized for greensand media regeneration. The $KMnO_4$ residual can be verified visually through two new sightglasses, one immediately upstream and one immediately downstream of the filter as shown on the process flow diagram in Appendix B.

The $KMnO_4$ chemical feed equipment includes a 55 gallon polyethylene tank for batching the dilute mix, a tank mixer, two injection pumps, a circulation pump for the pretreatment tank, and an ORP meter with two probes. Two new sightglasses should also be installed for oxidant residual monitoring. Cost information is shown below in Table 6.

Table 6 – Potassium Permanganate Feed System

Component	Manufacturer	Model	Estimated Cost
Peristaltic Metering Pump 1	LMI	Series A	$800
Peristaltic Metering Pump 2[1]	Watson Marlow	521CC	$3,500
Circulation Pump[2]	Little Giant	2-MD-SC	$300
55 Gallon Polyethylene Tank Package (KMnO4 Solution Tank)[3]	Snyder	5680000N	$800
¼ Hp TEFC Mixer SS Shaft[4]	J.L. Wingert	B-1-TE-PRP-WRD-39	$1,000
ORP Meter w/ 2 Probes[5]	Rosemount	1056-03-22-32-AN	$3,000
Labor			$4,500
		Total:	**$13,900**

1. Cost information from Alaska Pump.
2. Pricing from Harrington.
3. Cost information from GPS Environmental.
4. Cost information from Ferguson.
5. Pricing from USA Bluebook.

Greensand Filter and Turbidimeters

The existing greensand filter has deficiencies that which impair the operator's ability to produce the best possible water. The current underdrain is constructed of pvc of unknown condition and it is not screened. The filter is not equipped with a freeboard drain. No viewport window or illumination port is present to verify backwash performance or the condition of the media. The filter is equipped with a galvanized air scour header of unknown condition placed between the gravel support media and the greensand. The

lack of a freeboard drain impairs the air scour process resulting in poor filter efficiency and a potential for media fouling. A Solo Valve is used on the filter face piping that restricts backwash flow to the filter and may be responsible for shearing floc. A new filter equipped with a freeboard drain, viewport window, illumination port, and an underdrain properly equipped for air scour is recommended. New filter face piping is required to remove the existing Solo Valve. Costs and improvements related to the installation of a new greensand filter are provided in Table 7 below.

Figure 8 - Existing Greensand Filter and Piping

Several of the deficiencies above may be corrected with filter modifications and others cannot. Because of the limited construction funding, it may be desirable to retrofit the existing greensand filter instead of replacing it with a new one. At a minimum, new media should be installed, a drain down port added, and the face piping should be replaced. The service life of greensand media in Tuntutuliak is estimated to be 20 years assuming proper regeneration. Improvements to the existing filter are itemized in Table 8.

Two turbidimeter sensors are required to monitor the turbidity of water upstream and downstream of the greensand filter. Two Hach 1720E sensors with an SC200 controller may be utilized. The oxidized water turbidimeter sample point should be located just upstream of the greensand filter adjacent to a new sightglass. The filtered water turbidimeter sample point should be located just downstream of the greensand filter adjacent to a new sightglass. The sightglasses are to be used to aid in determining the proper amount of potassium permanganate addition. Sightglass data sheets are located in Appendix C.

Table 7 – New Greensand Filter and Turbidimeters

Component	Manufacturer	Model	Estimated Cost
30” Diameter Greensand Filter[1]	N/A	N/A	$25,000
Filter Face Piping[2]	N/A	N/A	$5,000
Turbidimeters & Controller[3]	Hach	1720E & SC200	$4,000
Labor			$10,500
		Total:	**$44,500**

1. Quote from West Coast Filters.
2. Information from recent construction.
3. Includes two turbidimeter sensors, one controller, one power cord, and shipping. Quote from www.hach.com.

Table 8 – Rehabilitate Existing Greensand Filter and Turbidimeters

Component	Manufacturer	Model	Estimated Cost
New Filter Media[1]	N/A	N/A	$3,000
Filter Face Piping[2]	N/A	N/A	$5,000
Turbidimeters & Controller[3]	Hach	1720E & SC200	$4,000
Labor			$7,500
		Total:	**$19,500**

1. Estimated from prior quotes.
2. Information from recent construction.
3. Includes two turbidimeter sensors, one controller, one power cord, and shipping. Quote from www.hach.com.

Air Scour Unit

Air scour is necessary for proper filter maintenance. The existing air compressor currently used for air scour is rated for 10.5 cfm free air and 6.2 cfm at 100 psi. For a 30” filter, the desired air capacity is 20 cfm or 4 cfm/ft^2. As a result, a new air scour package capable of providing adequate flow to the new 30” filter is proposed. This air scour package includes a blower, motor, silencer, and PRV integrated into a skid mounted package. New air piping should not be necessary.

Table 9 – Air Scour Unit

Component	Manufacturer	Model	Estimated Cost
Air Blower Package[1]	Airmac	B-2M-3	$4,000
Motor Control & Electrical[2]	N/A	N/A	$1,500
Labor			$3,000
		Total:	**$8,500**

1. Quote from Airmac, 3/14/11
2. Cost information from recent construction.

Granular Activated Carbon Filtration

TOC levels in the Tuntutuliak raw water are of a magnitude that is typically associated with DBP levels in the finished water that exceed regulatory limits. Granular activated carbon (GAC) filtration is recommended for organics removal to minimize the potential DBP formation and improve taste and odor of the finished water. GAC filters require backwash but not air scour. As a result, the existing filter could be reused as a GAC filtration vessel. The existing filter media could be replaced with GAC and new filter face piping could be installed to accommodate this filter and the associated backwash. This vessel would be located downstream of the filtered water turbidimeter. These improvements are summarized in Table 10.

Table 10 – GAC Media in Existing Filter

Component	Manufacturer	Model	Estimated Cost
GAC Media for Existing Filter[1]	N/A	N/A	$1,000
Filter Face Piping[2]	N/A	N/A	$5,000
Labor			$3,000
		Total:	**$9,000**

1. Cost information from West Coast Filters.
2. Information from recent construction.

If the existing greensand filter is rehabilitated, a new GAC filter vessel would also be required. A new GAC filter and related improvements are provided in Table 11. The estimated service life for GAC in Tuntutuliak is 6-12 months depending on amount of water treated and organic loading. Spent media is suitable for disposal in the local landfill. The approximate cost for GAC media replacement is $1,000.

Table 11 – New GAC Filter

Component	Manufacturer	Model	Estimated Cost
New GAC Filter[1]	Siemens	N/A	$9,000
Piping[2]	N/A	N/A	$2,000
Labor			$4,000
		Total:	**$15,000**

1. Cost information from West Coast Filters.
2. Information from recent construction.

Polymer Injection System

The addition of a polymer injection system in Tuntutuliak would aid in the ability of the greensand filter to remove turbidity and organics which would increase the media life in the GAC filter. The system would be setup to automatically batch dilute polymer from neat polymer. Neat polymer would be stored in a 35 gallon tank and injected into a static mixer via a neat polymer pump. The neat polymer will be mixed with hot water and enter the dilute polymer tank. A float in the dilute polymer tank will signal the neat polymer pump when the dilute polymer tank reaches a low level setpoint. Dilute polymer injection would be controlled by a streaming current detector to provide optimum coagulant dose and the polymer would be injected upstream of the greensand filter adjacent to the residual $KMnO_4$ injection point.

The polymer injection system would consist of a neat polymer pump, neat polymer tank, batch injector, dilute polymer pump, dilute polymer tank, mixer, and streaming current detector.

Table 12 – Polymer Injection System

Component	Manufacturer	Model	Estimated Cost
Neat Polymer Pump	Watson Marlow	521CC	$2,000
Neat Polymer Tank	Snyder		$650
Batch Injector	Mixmate		$1,500
Dilute Polymer Pump	Watson Marlow	521CC	$3,500
Dilute Polymer Tank	Snyder		$850
¼ Hp TEFC Mixer SS Shaft	J.L. Wingert	B-1-TE-PRP-WRD-39	$1,000
Streaming Current Detector	Milton Roy	SC5200	$11,000
Labor			$6,000
		Total:	**$26,500**

Capital Cost Summary

Table 13 below summarizes the capital cost for the proposed upgrades. Freight for all items is included in this table. The total estimated construction cost for all recommended upgrades for the Tuntutuliak WTP is $150,400.

Table 13 – Cost Summary

Improvement Category	Estimated Cost
Watering Point Upgrades	$7,500
Well System Upgrades	$7,000
Pretreatment Upgrades	$18,500
Potassium Permanganate Feed System	$13,900
New Greensand Filter / Add Turbidimeters	$44,500
Air Scour Unit	$8,500
Rehab Existing Filter as GAC Filter	$9,000
Polymer Injection System	$26,500
Freight[1]	$15,000
Total:	**$150,400**

1. 15,000 lbs of freight estimated at an assumed average shipping cost to Tuntutuliak of $1.00/lb.

Conclusions and Recommendations

The cost of the proposed upgrades to the Tuntutuliak WTP exceeds the available construction budget of approximately $120,000 including CM services. CM services are anticipated to be approximately $35,000 resulting in $85,000 for actual construction. The upgrades were selected for their ability to address the deficiencies of the current WTP and treatment process. As a result, no single upgrade may be eliminated based on necessity, though the immediate impact of each upgrade on the treated water quality may be evaluated. It is recommended that the upgrades that provide the most impact on water quality be implemented first followed by the rest of the upgrades when funding becomes available. Because the ranking of improvements is subjective, two improvement alternatives are provided for consideration. The first alternative includes a new greensand filter and rehabilitation of the public watering point and the second alternative includes a rehabilitated greensand filter and the addition of coin-op only to the public watering point. Polymer is shown but not included as a priority in either alternative due to budget considerations.

Table 14 – Alternative 1 Improvements

Rank	Upgrade	Cost	Running Total
1	Pretreatment Upgrades	$18,500	$18,500
2	$KMnO_4$ System	$13,900	$32,400
3	New Greensand Filter Unit	$44,500	$76,900
	Freight for Above	$10,000	$86,900[1]
4	Air Scour Unit	$8,500	$95,400
5	Rehab Existing Filter as GAC Filter	$9,000	$104,400
6	Well System Upgrades	$7,000	$111,400
7	Watering Point Upgrades	$7,500	$118,900
8	Polymer Injection System	$26,500	$145,400
	Freight for Above	$5,000	$150,400

1. Limit of anticipated construction money available.

Based on the above cost estimate, the Pretreatment Upgrades, $KmnO_4$ System, and Greensand Filter Unit could be installed while the Air Scour Unit, GAC Filter Unit, Well System Upgrades, Watering Point Upgrades, and polymer injection system would have to be scheduled for installation when further funding becomes available.

Table 15 – Alternative 2 Improvements

Rank	Upgrade	Cost	Running Total
1	Pretreatment Upgrades	$18,500	$18,500
2	$KmnO_4$ System	$13,900	$32,400
3	Improve Existing Greensand Filter / Add Turbidimeters	$19,500	$51,900
4	Air Scour Blower	$8,500	$60,400
5	GAC Filter Unit	$15,000	$75,400
6	Watering Point Coin-op	$3,000	$78,400
	Freight for Above	$12,000	$90,400[1]
7	Well System Upgrades	$7,000	$97,400
8	Polymer Injection System	$26,500	$123,900
	Freight for Above	$3,000	$126,900

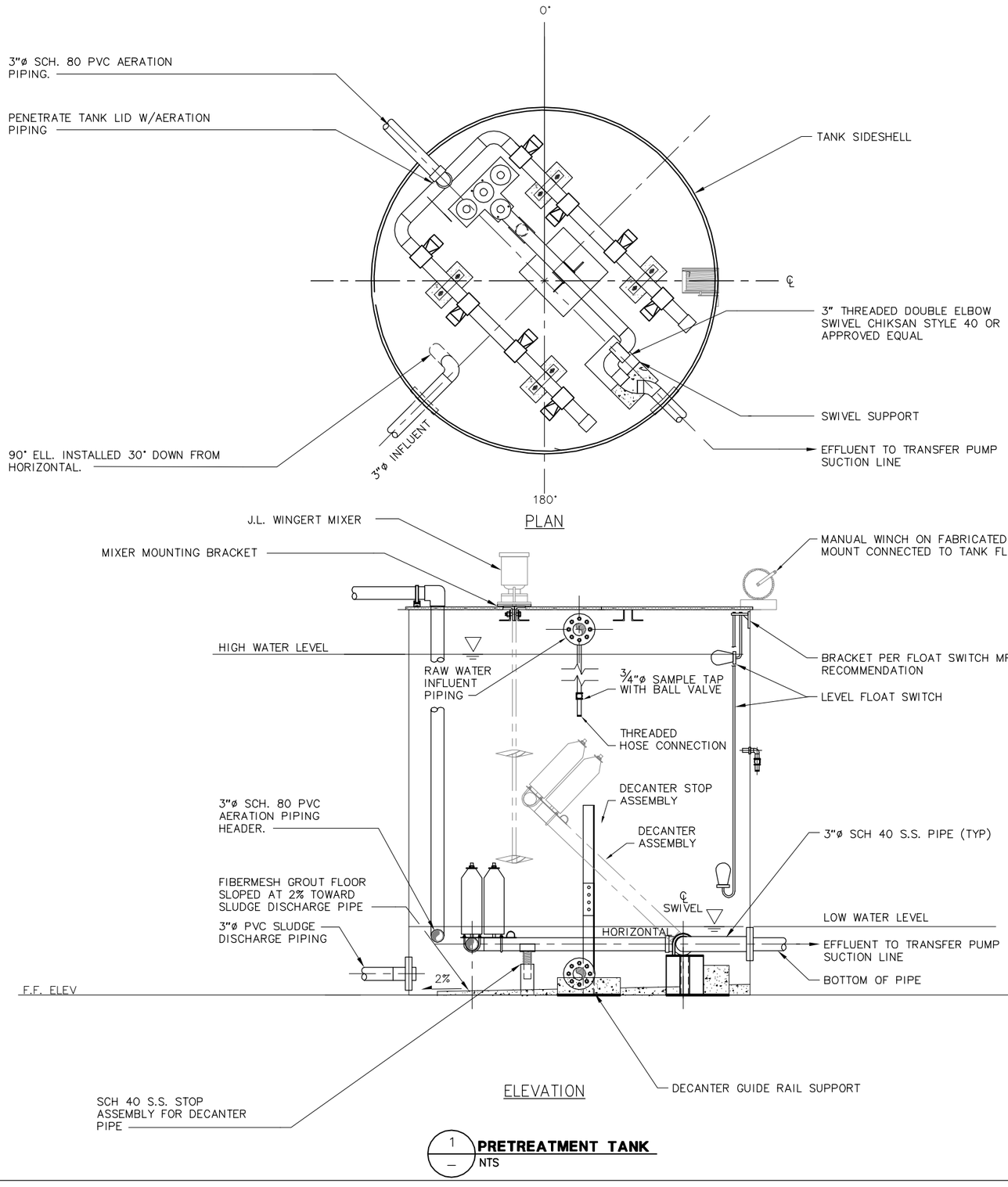
1. Limit of anticipated construction money available.

Alternative 2 allows for the addition of the new air blower as well as a new GAC filter and the addition of coin operation at the public watering point. Several of the existing greensand filter deficiencies will remain which may be addressed as future funding

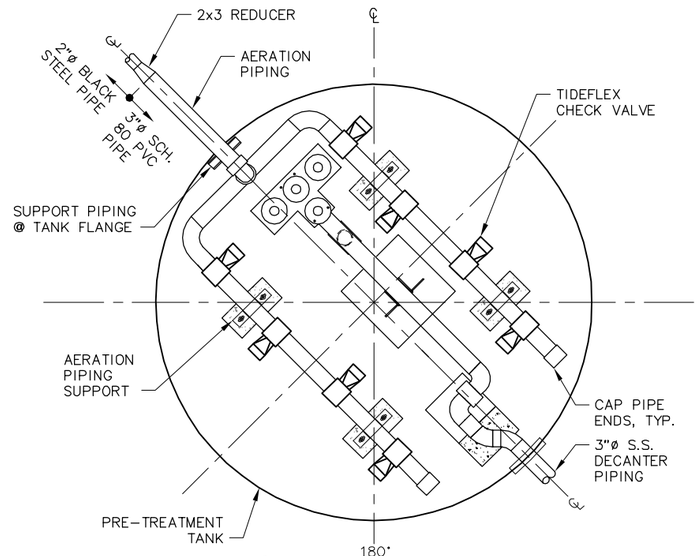
allows. The well system upgrades polymer injection system would also remain a priority for the community.

The community has stated a preference for Alternative 2 which allows for a larger number of improvements to be completed.

End of Memorandum



1 — NTS
PRETREATMENT TANK



2 — NTS
AERATION PIPING LAYOUT

Alaska Department of Environmental Conservation
Division of Water
Village Safe Water Program
555 Cordova Street 4th Floor
Anchorage, Alaska 99501

CRW ENGINEERING GROUP LLC
3940 ARCTIC BLVD, SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
FAX: (907) 561-2273

TUNTUTULIAK, ALASKA
WATER TREATMENT PLANT
PRETREATMENT TANK

NO.	REVISION	BY	DATE

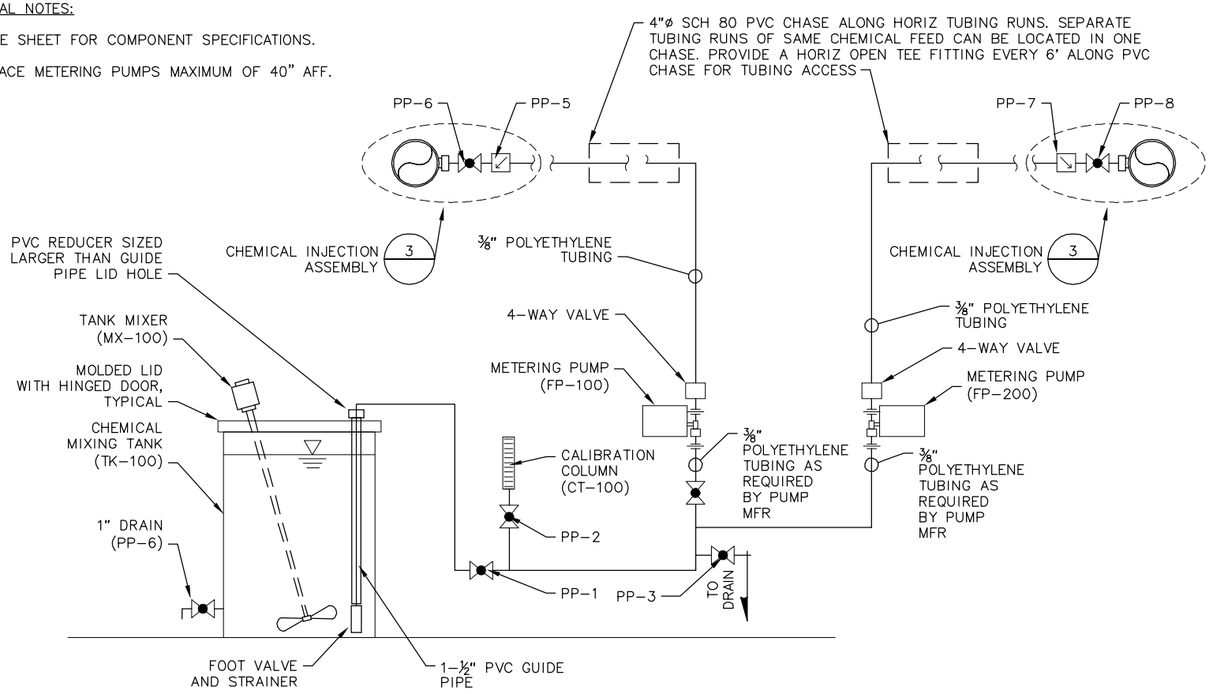
Plot Date 5/12/11
Designed
Drawn
Approved

Sheet No.
SHEET — OF —

File: J:\Jobsdata\81801.00 Tuntutuliak WTP & Washeteria Lagoon\00 CADD\01 Working Set\01 Civil\81801.00 Pre-Treatment Tank.dwg

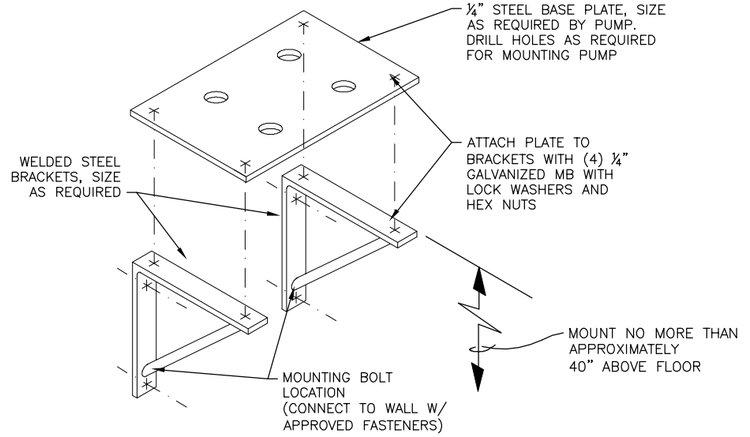
GENERAL NOTES:

1. SEE SHEET FOR COMPONENT SPECIFICATIONS.
2. PLACE METERING PUMPS MAXIMUM OF 40" AFF.



1 — POTASSIUM PERMANGANATE CHEMICAL FEED SYSTEM

SCALE: NTS

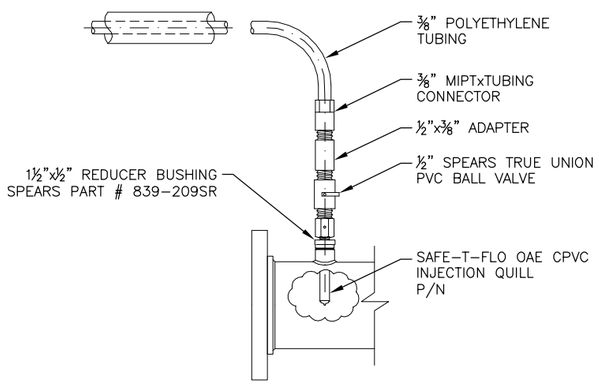


NOTES:

1. PROVIDE SIMILAR PRE-FABRICATED WALL MOUNT BRACKET AS MANUFACTURED BY LMI OR APPROVED EQUAL.
2. HOT DIP GALVANIZE ENTIRE ASSEMBLY AFTER FABRICATION.

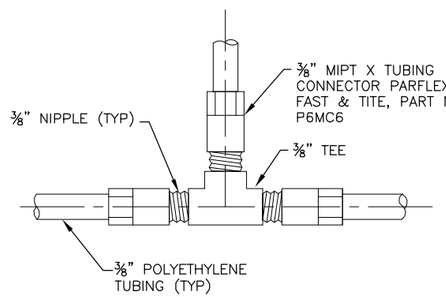
2 — METERING PUMP SUPPORT

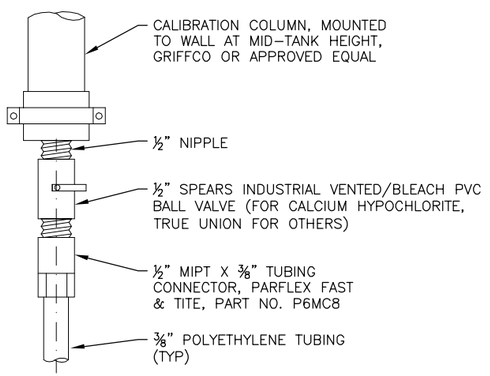
SCALE: NTS



3 — CHEMICAL INJECTOR ASSEMBLY DETAIL

SCALE: NTS





4 — CALIBRATION COLUMN ASSEMBLY DETAILS

SCALE: NTS

Alaska Department of Environmental Conservation
Division of Water

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Anchorage, Alaska 99501

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TUNTUTULIAK, ALASKA
WATER TREATMENT PLANT

POTASIUM PERMANGANATE INJECTION SYSTEM

NO.	REVISION	BY	DATE

Plot Date 5/12/11
Designed PAR
Drawn CMK
Approved PAR

Sheet No.
SHEET — OF —

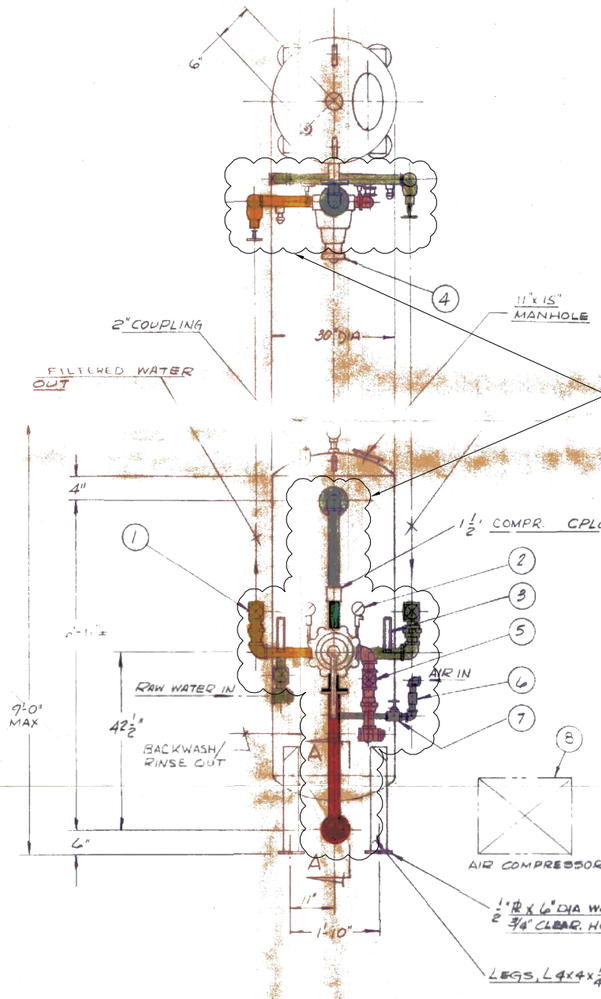
File: J:\Jobsdata\81801.00 Tuntutuliak WTP & Washeteria Lagoon\00 CADD\01 Working Set\Process\81801.00 TUN - Details.dwg

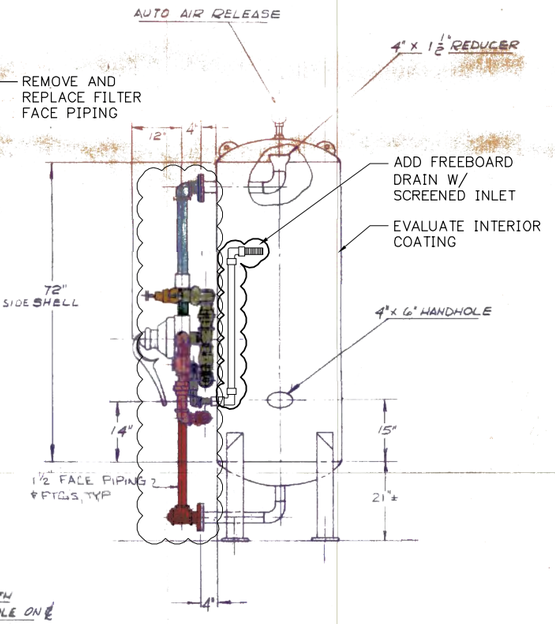
NOTES

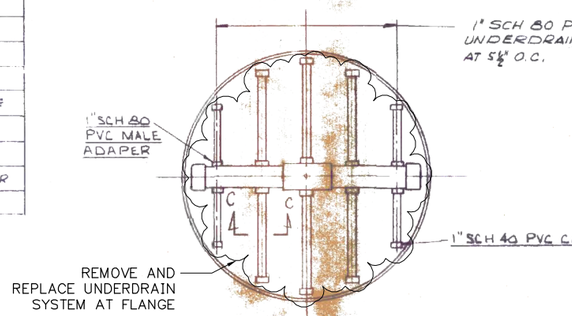
1. TANK IS 100 LB. ASME CODE. SANDBLASTED INSIDE (SP10) AND OUTSIDE (SP6). PAINTED INSIDE WITH 2 COATS COAL TAR EPOXY 16 MILS TOTAL. OUTSIDE COATED WITH 2.5 MILS RUST INHIBITIVE ZINC - RIMER.
2. EXTERNAL PIPING IS SCH 40 BLACK PIPE SIZE AS INDICATED WITH 150 lb FTG'S.

ITEM	QTY	DESCRIPTION
1	3	1½" BRONZE GATE VALVE
2	2	3½" PRESSURE GAUGE/SAMPLE COCK ASSY.
3	2	IMPACT TYPE FLOWMETER
4	1	AQUAMATIC 1½" SOLO VALVE, 404 DCR
5	1	DEZURIK 118 S 1½" ECCENTRIC PLUG VALVE
6	1	1" CHECK VALVE
7	1	1" GLOBE VALVE
8	1	SPEEDAIRE MODEL 3Z419B COMPRESSOR

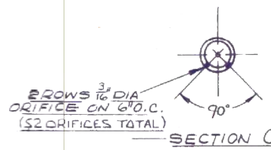
REV.	REVISION	DATE	BY



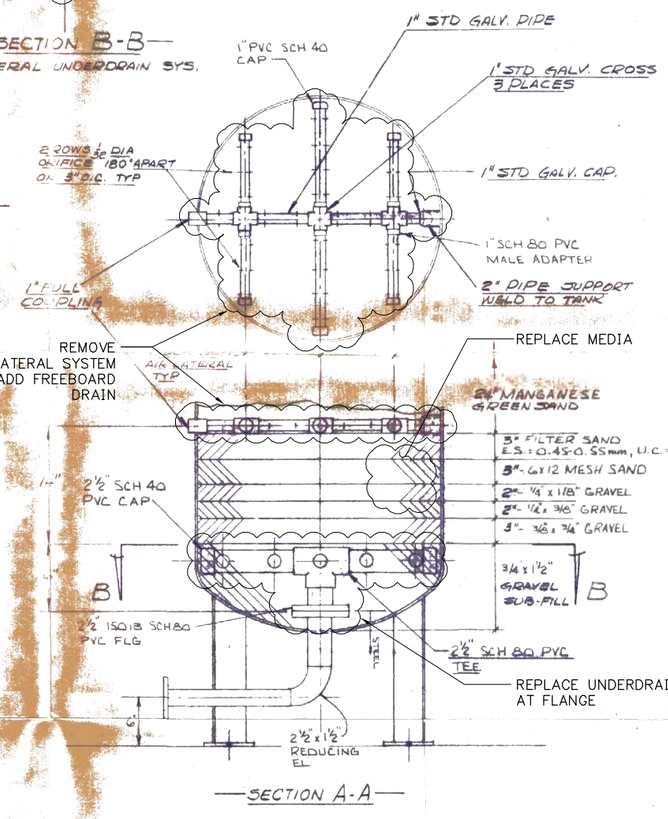




SECTION B-B
LATERAL UNDERDRAIN SYS.



SECTION C-C



SECTION A-A

30" DIA x T2 SIDE SHELL VERTICAL PRESSURE FILTER TUNTUTULIAK, ALASKA	RESCUE ENGINEERS ENGINEERS • MANUFACTURERS
SCALE: ¾"=1'-0" & 1½"=1'-0" DR. BY: CMK CK. & APP. BY: R.O.G. DATE: MAR. 2-52 JOB NO. 1034	DRAWING NO. L-1042 REV.

Alaska Department of Environmental Conservation
Division of Water

Village Safe Water Program
555 Cordova Street 4th Floor
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TUNTUTULIAK, ALASKA
WATER TREATMENT PLANT
VERTICAL PRESSURE FILTER

NO.	REVISION	BY	DATE

Plot Date 5/12/11
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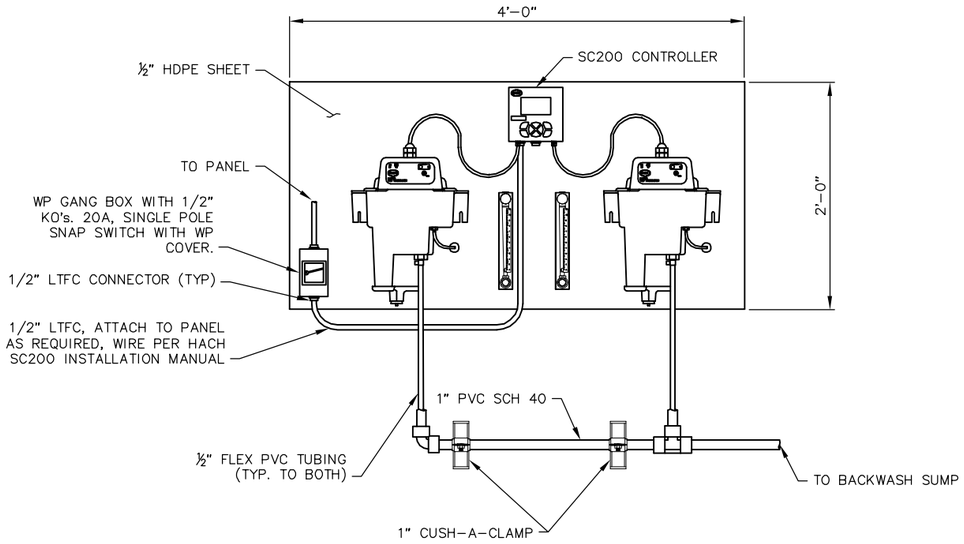
Drawn CMK
Approved PAR

Sheet No. — SHEET — OF —

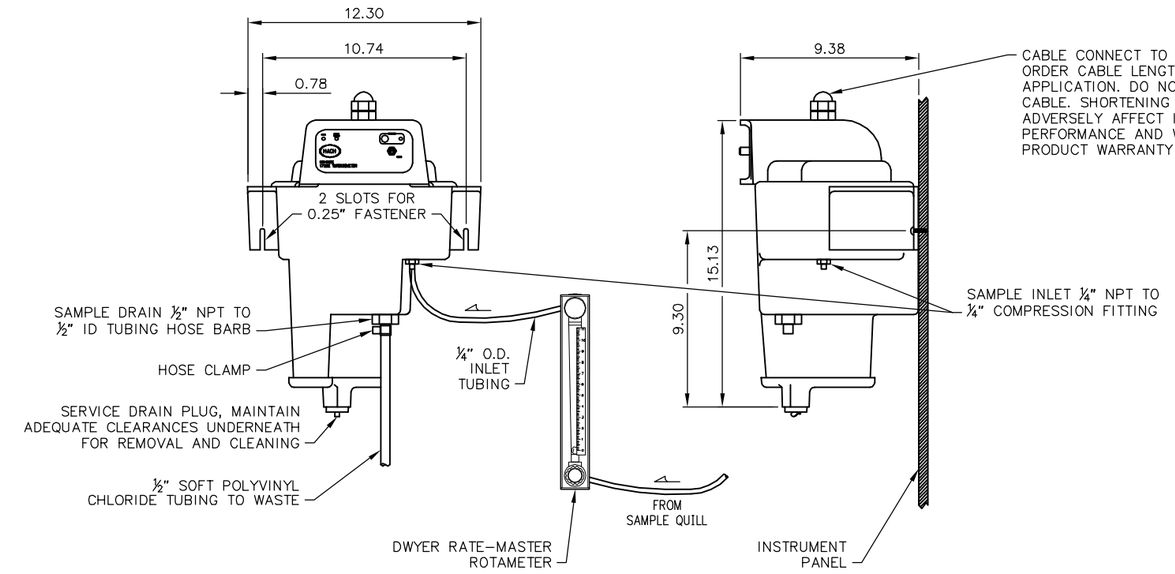
File: J:\Jobsdata\81801.00 Tuntutuliak WTP & Washeteria Lagoon\00 CADD\01 Working Set\Process\81801.00 TUN - Vertical Pressure Filter.dwg



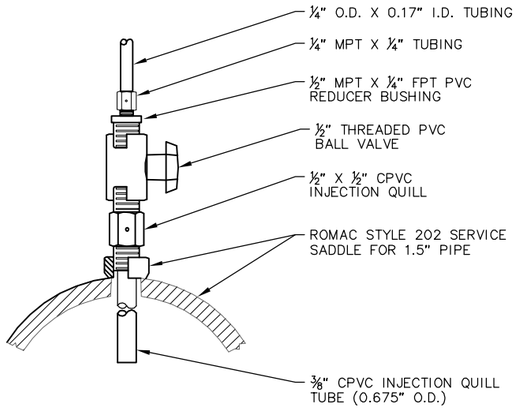
1 — **TURBIDIMETER PANEL**
SCALE: NTS

NOTES:

1. ALL DIMENSIONS ARE IN INCHES.
2. ALLOW AT LEAST 10" ABOVE THE INSTRUMENT FOR REMOVAL OF THE HEAD ASSEMBLY.
3. INSTALL PER MANUFACTURER'S WRITTEN INSTRUCTIONS.
4. MOUNT THE SENSOR BODY AS CLOSE AS POSSIBLE TO THE SAMPLE TAP (I.E. FILTER EFFLUENT) TO MINIMIZE LAG TIME. LAG TIME SHALL NOT EXCEED 30 SECONDS.
5. MOUNT SENSOR/ANALYZER PERFECTLY LEVEL.



2 — **TURBIDIMETER (HACH MODEL •1720E) DETAIL**
SCALE: NTS



3 — **CPVC SAMPLE QUILL**
SCALE: NTS

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TUNTUTULIAK, ALASKA
WATER TREATMENT PLANT
TURBIDIMETER DETAILS

NO.	REVISION	BY	DATE

Plot Date 5/12/11
Designed PAR
Drawn CMK
Approved PAR

Sheet No.
SHEET — OF —

File: J:\Jobsdata\81801.00 Tuntutuliak WTP & Washeteria Lagoon\00 CADD\01 Working Set\Process\81801.00 TUN – Turbidimeter.dwg

TUNTUTULIAK, ALASKA HEAT RECOVERY STUDY

PREPARED BY:

Alaska Native Tribal Health Consortium
Division of Environmental Health and Engineering
3900 Ambassador Dr., Ste 301, Anchorage AK 99508
Phone (907) 729-3600 / Fax (907) 729-4046

June 24, 2013

EXECUTIVE SUMMARY

The Tuntutuliak power plant and water treatment plant / washeteria (WTP/W) building were evaluated for heat recovery potential. The total estimated annual heating fuel used by the WTP/W is approximately 7,100 gallons. The estimated fuel savings realized by implementing a heat recovery system combined with the diesel engines and the wind energy is pproximately 6,600 gallons. The estimated cost for the heat recovery project is $429,000. The simple payback based on a 2013 fuel cost of $6.80/gallon is 9.6 years. The ratio of NPV benefit to cost (B/C) was estimated based on the system lifetime of 20 years. The estimated B/C value is 1.9.

Assuming construction in 2015, the design and construction cost plus a 2 year escalation rate of 3% is $456,000.

The Tuntutuliak power plant is currently being modified to incorporate wind power. An electric boiler is currently part of the generator plant. The impact of the wind power is unknown at this point without comparing the actual power generation data between two energy sources of diesel engines and wind turbines, but the analysis for the heat recovery study illustrates that the benefit of recovered heat with the stand-alone diesel engines is approximately 6,150 gallons. There is no significant change in fuel savings for the community between two heat recovery sources (stand-alone diesel engines, and diesel engines combined with the wind energy) because excessive wind energy offsets the electricity generated by the diesel engines. The less electricity generated by the engine eventually results in less heat rejected by the engines to the jacket water.

1.0 INTRODUCTION

The Alaska Native Tribal Health Consortium (ANTHC) reviewed the feasibility of providing recovered heat from the power plant to the existing WTP / Washeteria (WTP/W) in Tuntutuliak. ANTHC also developed a budgetary project cost estimate based on Force Account Construction, including Engineering and Construction Administration.

The existing WTP/W building is hydronically heated. An energy audit of the facility performed in 2011 estimated approximately 7,114 gallons/year of fuel consumption and importantly, much of this load is present in the summer as well as winter. New equipment will include a large brazed plate heat exchanger, a new circulator pump, and controls to prevent back feeding of heat to the generator facility.

The existing power plant was designed for heat recovery and has a brazed plate heat exchanger and electric boiler (primary load) already installed. At present, the Tuntutuliak power plant is being upgraded to incorporate wind power. Per conversations with the power plant operators and contractors currently adding wind power generation, the existing heat exchanger needs to be replaced because of fouling, but other than that no additional work is required to incorporate heat recovery.

The wind-diesel system in Tuntutuliak consists of five 95 KW Windmatic 17s turbines with each turbine having variable speed controller. Tuntutuliak currently has thirty 6 KW Steffer heaters served as the secondary loads in various residences to take the excessive power produced by the wind turbines, but there is still excessive power to divert beyond the power

usage of thirty Steffes heaters. The electric boiler will be used to convert excess wind power into heat used by WTP/W.

Additional assumptions have been made in the development of this report, including, but not limited to, the proposed arctic piping route, building heating loads, and flow rates and pressure drops of the heat recovery system. It is anticipated that refinements in arctic pipe size and routing, pump and heat exchanger sizing, and other design elements will be required as the project progresses to final design.

Available as-built information was obtained from Tuntutuliak power regarding the 2011 power plant electrical loads as submitted for PCE. End-user annual fuel use was obtained from engineering estimates. Site visits were made to the existing washeteria and power plant to confirm accuracy of information obtained.

2.0 OVERVIEW

The purpose of this study is to provide an estimate of the heat that can be recovered from the power plant diesel engines and used to offset heating oil consumption at the nearby WTP/W. Useable recovered heat is quantified in gallons of heating fuel saved using a gross heating value of 134,000 BTU per gallon of #1 arctic diesel fuel and an overall boiler efficiency of 75% for a net heating value of 100,000 BTU per gallon.

The WTP/W studied for heat recovery is located within a 600-foot radius of the Tuntutuliak power plant. This analysis evaluates the potential to provide recovered heat to the WTP/W. The estimated average annual heating fuel consumption is 7,100 gallons.

3.0 ESTIMATED RECOVERED HEAT UTILIZATION

A heat recovery utilization spreadsheet has been developed to estimate the recoverable heat based on monthly total electric power production, engine heat rates, building heating demand, washeteria loads, heating degree days, passive losses for power plant heat and piping, and arctic piping losses. The spreadsheet utilizes assumed time-of-day variations for electric power production and heat demand. Power generation data from fiscal year 2011 is used in the spreadsheet. The estimated heat rejection rate for the lead power plant genset, a John Deere 6090 (250 KW, engine heat reject rate of approximately 1,503 Btu/KWh according to John Deer engine installation criteria at full load), is used to estimate available recovered heat. Heating degree-days for Tuntutuliak were utilized for this site. All arctic piping is assumed to be routed above grade. All interior power plant hydronic piping is assumed to be 4-inch pipe with 1 inch of foam rubber insulation.

The spreadsheet uses monthly heating degree-days to distribute annual fuel consumption by month. The washeteria commercial heating loads are field verified as approximately 70% of maximum utilization for 8 hours a day, 5 days a week. The end-user hourly heat load is compared to the hourly available heat from the power plant, less power plant heating loads and parasitic piping losses, and the net delivered heat to the end-user is determined.

Following is a summary of annual fuel use and estimated heat utilization in equivalent gallons of fuel for each building:

Facility	Estimated Annual Fuel Use without HR (Gallons)	Estimated Annual Fuel savings with wind power incorporated (Gallons)	Estimated Annual Fuel Savings without wind power (Gallons)
Washeteria	7,144	6,565	6,145
Total	**7,144**	**6,565**	**6,145**

4.0 HEAT RECOVERY SYSTEM DESCRIPTION AND OPERATION:

The heat recovery system captures jacket water heat generated by diesel engines and excess wind power that is typically rejected to the atmosphere by the radiators. The recovered heat is transferred via above-grade arctic piping to the end user. The objective is to reduce the consumption of expensive heating fuel by utilizing available recovered heat.

Although heat recovery is an excellent method of reducing heating fuel costs, recovered heat is a supplementary heat source and it is imperative that the end-user facility heating systems are operational at all times.

Hot engine coolant is piped through a plate heat exchanger located at the power plant. Heat is transferred from the engine coolant to the recovered heat loop without mixing the fluids. Controls are used to prevent subcooling of the generator engines and reducing electric power production efficiency. The recovered heat fluid is pumped through buried insulated pipe to the end-user facilities, and is typically tied into the end-user heating system using a plate heat exchanger.

4.1 POWER PLANT TIE-IN

No modifications to the power plant cooling system are included, except those required to connect the arctic piping to the power plant heat exchanger and replacement of the heat exchanger.

All heat recovery piping inside the power plant will be insulated with a minimum of 1-in foam insulation. All valves will be either bronze ball valves or lug style butterfly valves with seals compatible with 50/50 glycol/water mixtures at 200F. Air vents, thermometers, pressure gauges, drain valves, and pressure relief valves will also be provided.

4.2 ARCTIC PIPING (Recovered Heat Loop)

The proposed arctic piping consists of a 3 inch polypropylene and fiberglass composite carrier pipe (Aquatherm Climatherm phaser composite) insulated with 3.5" of polyurethane foam insulation, and aluminum outer jacket. The piping will be supported on sleepers on the ground surface and run from the power plant within existing rights-of-way to the end-user washeteria.

The recovered heat fluid will be a 50/50 Propylene Glycol/Water solution to provide freeze protection to the piping.

4.3 END-USER BUILDING TIE-IN

WTP/W building tie-in consists of a brazed plate heat exchanger with motorized bypass valve to prevent back feeding heat to power plant. A brazed plate heat exchanger located in the

WTP/W mechanical room will be tied into the boiler return piping to preheat the boiler water prior to entering the boiler. If required, a heat injection pump will be used to avoid introducing excessive pressure drop in the building heating system. The maximum anticipated delivered recovered heat supply temperature is about 190F. When there is insufficient recovered heat to meet the building heating load, the building heating system (boiler or heater) will fire and add heat. Off the shelf controls will lock out the recovered heat system when there is insufficient recovered heat available.

The existing dryers will be replaced with new dryers with additional heating capacity to improve dryer performance when using recovered heat.

Typical indoor piping will be type L copper tube with solder joints. Isolation valves will be solder end bronze ball valves or flanged butterfly valves. All piping will be insulated with a minimum of 1-in insulation with an all-service jacket. Flexibility will be provided where required for thermal expansion and differential movement. Air vents, thermometers, pressure gauges, drain valves, and pressure relief valves will also be provided.

The WTP/W will also receive a BTU meter to provide recovered heat use totalization and instantaneous use.

4.4 RIGHTS-OF-WAY ISSUES

There are no apparent conflicts with rights-of-ways for the arctic piping between the power plant and the end-user building, as the route is entirely within existing road rights-of-ways and on city property.

A Heat Sales/Right-of-Entry Agreement will be required between the power utility and the end user to define the parties' responsibilities, detail the cost of recovered heat, and authorize the connection to the power plant heat recovery equipment.

4.5 POTENTIAL RISKS AND UNKNOWNS

Incorporation of wind turbines to reduce generator power consumption will most likely increase the amount of recovered heat available. At present, the combined power produced from the diesel fired generators and three wind turbines distributes throughout the community and delivered to 30 electric Steffes heaters in the homes. The engine heat reject rate of approximately 1,740 Btu/KWh was used to calculate the estimated annual fuel savings with wind power incorporated.

Per discussions with the power plant operator, the diesel-fired generators are expected to maintain a base load of 60 KW when the wind turbines produce electricity. Currently, only three wind turbines are in operable conditions and their average power production rate is approximately 90 KW. The excessive electric power with a minimum of 30 KW will be provided to the power plant electric boiler to level out wind fluctuations when all five wind turbines operate in future.

The minimum recovered heat benefit is expected to be approximately 6,600 gal / year offset fuel use.

5.0 PRELIMINARY EQUIPMENT SELECTIONS

The following initial equipment selections are sized and selected based on preliminary data and will require minor modifications to reflect final design.

5.1 Heat Exchangers

Based on initial selected flow rates, brazed plate heat exchangers appear to be adequate for all locations. Initial heat exchanger selections are as follows.

HX-1: (Power Plant). 300 MBH capacity
Primary: 70 GPM 190F EWT (50% ethylene glycol), 0.6 PSI max WPD
Secondary: 35 GPM 185F LWT (50% propylene glycol) 0.23 PSI max WPD

HX-2: (Washeteria). 300 MBH capacity.
Primary: 35 GPM 185F EWT (50% propylene glycol), 1.0 PSI max WPD
Secondary: 35 GPM 180F LWT (50% propylene glycol) 1.5 PSI max WPD

5.2 Arctic Piping

The length of heat recovery loop piping between the power plant and most distant facility is approximately 1,400 ft, round trip. The arctic piping utilizes 3-in carrier pipe to minimize pressure drop and reduce pumping energy. The pipe itself consists of a 3-in composite carrier pipe with 4.5-in polyurethane foam insulation and an aluminum outer jacket. The specified product is durable and resistant to crushing or abrasion.

5.3 Circulating Pumps

P-HR1 & 2: Heat recovery loop to end-user buildings
Flow = 35 GPM, Head = 35 ft
Initial Selection: Grundfos Magna 65-120 with integrated VFD and differential pressure controller, 35 GPM at 35 ft TDH, 900W

5.4 Expansion Tank

Total heat recovery loop volume is approximately 550 gallons. Pressure relief at the power plant heat exchanger will be 45 PSIG and the maximum normal operating pressure will be 40 PSIG.

ET-1: System requirements: 80 gallon tank and 41 gallon acceptance
Select: Extrol ST-210V, 86 gallon tank and 46 gallon acceptance

5.5 GLYCOL MAKEUP

The existing glycol make-up system at the washeteria will be adapted to accommodate filling the system and adding additional glycol.

5.6 CONTROLS

Heat recovery system will use an off the shelf differential temperature controller to actuate a 3-way valve and start/stop heat injection pump (if used). Control will provide load shedding, freeze protection, and prevent backfeeding of boiler heat into heat recovery system. In addition, A BTU meter will be provided at each facility using recovered, displaying

instantaneous temperatures and heat transfer, as well as totalizing BTUs used.

Differential Controller: Tekmar Model 155 differential temperature control

Control Valve:

CV-1 Washeteria: 2" 3-way motorized control valve with 24v Actuator

BTU Meter:

BTU-1 Washeteria: KEP BTU meter with 2" magnetic flow meter and matching temperature elements.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Estimated construction costs were determined based on prior recent heat recovery project experience, and include materials, equipment, freight, labor, design, construction management, and startup and testing. All work at the power plant and WTP/W, along with design and construction management/administration for the complete project, is included in the Base Project cost. Incremental costs for arctic pipe, end-user building renovations, and overhead and freight are estimated individually for each of the other end-user buildings (refer to attached cost estimate).

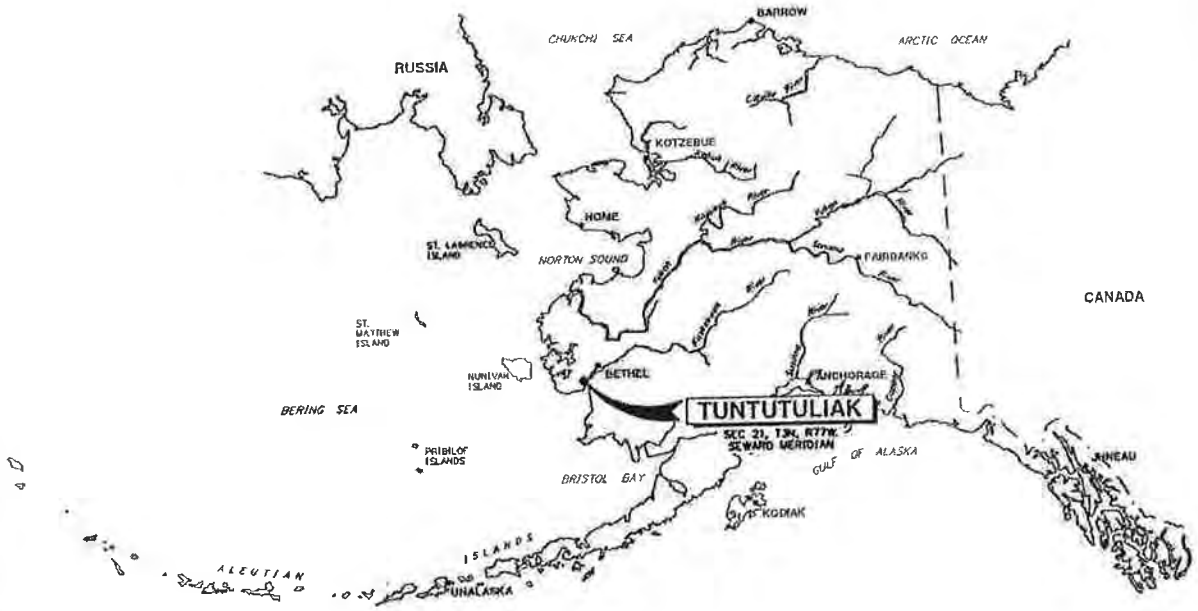
The estimated project cost for is $423,000. Estimated annual fuel savings are approximately 6,600 gallons. Using a 2013 fuel price of $6.80/gallon results in an estimated annual community savings of $44,640 for a simple payback of 9.6 years.

Funding for design and construction isn't expected until 2014 fall, with construction occurring 2015 summer. With the 2 year escalation rate of 3% per year, the estimated 2015 project cost is $456,000 and the corresponding benefit/capital cost (B/C) ratio is **1.9** (refer to attached B/C model spreadsheet).

APPENDIX

1. CAD Drawings
   A. Cover Page
   B. Community Site Plan
   C. Site Plan
   D. System Schematic
   E. Sleepers Pipe Support Detail
2. Figure 1. Recovered Heat Utilization.
3. Figure 2. Recovered Heat.
4. Cost Estimates for Heat Recovery Project.
5. Benefits to Capital Costs Ratio.
6. Recovered Heat Utilization Simulation Work Sheet.

TUNTUTULIAK, ALASKA
ANTHC RECOVERED HEAT STUDY



SHEET LIST TABLE	
Sheet Number	**Sheet Title**
1	COVER
2	COMMUNITY SITE PLAN
3	SITE PLAN
4	SYSTEM SCHEMATIC
5	SLEEPER DETAIL

Alaska Native
Tribal Health Consortium
Division of Environmental
Health and Engineering
1901 Bragaw Street, Suite 200
ANCHORAGE, ALASKA, 99508-3440
(907) 729-3600

TUNTUTULIAK, AK
ANTHC RECOVERED HEAT STUDY

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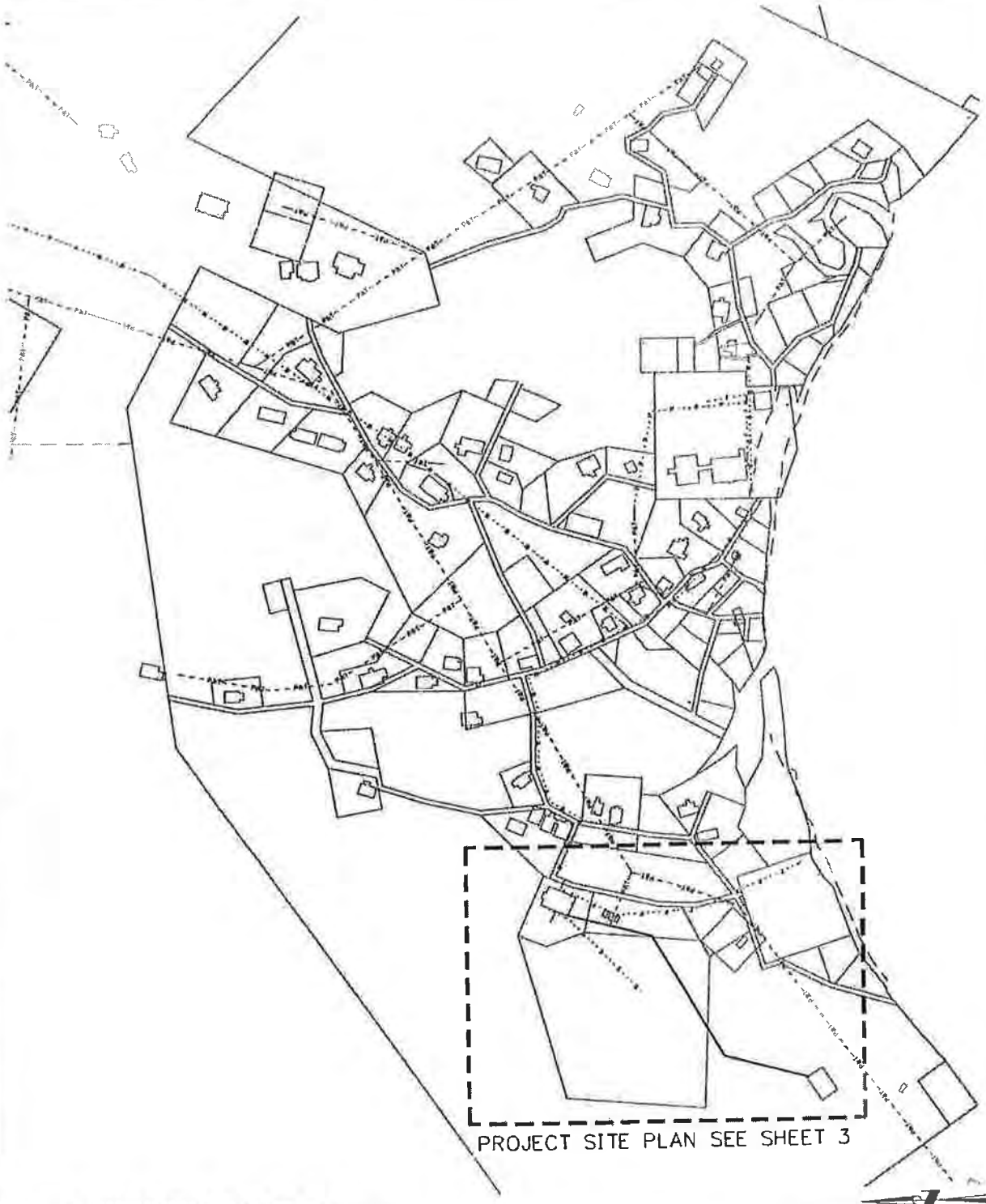
CHECKED BY:	WF	SHEET	1 OF 5



A1 **COMMUNITY SITE PLAN**
NTS

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Alaska Native Tribal Health Consortium
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TUNTUTULIAK, AK
ANTHC RECOVERED HEAT STUDY

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DRAWN BY:	TH	FILE NAME:	WTL-G-STSITE
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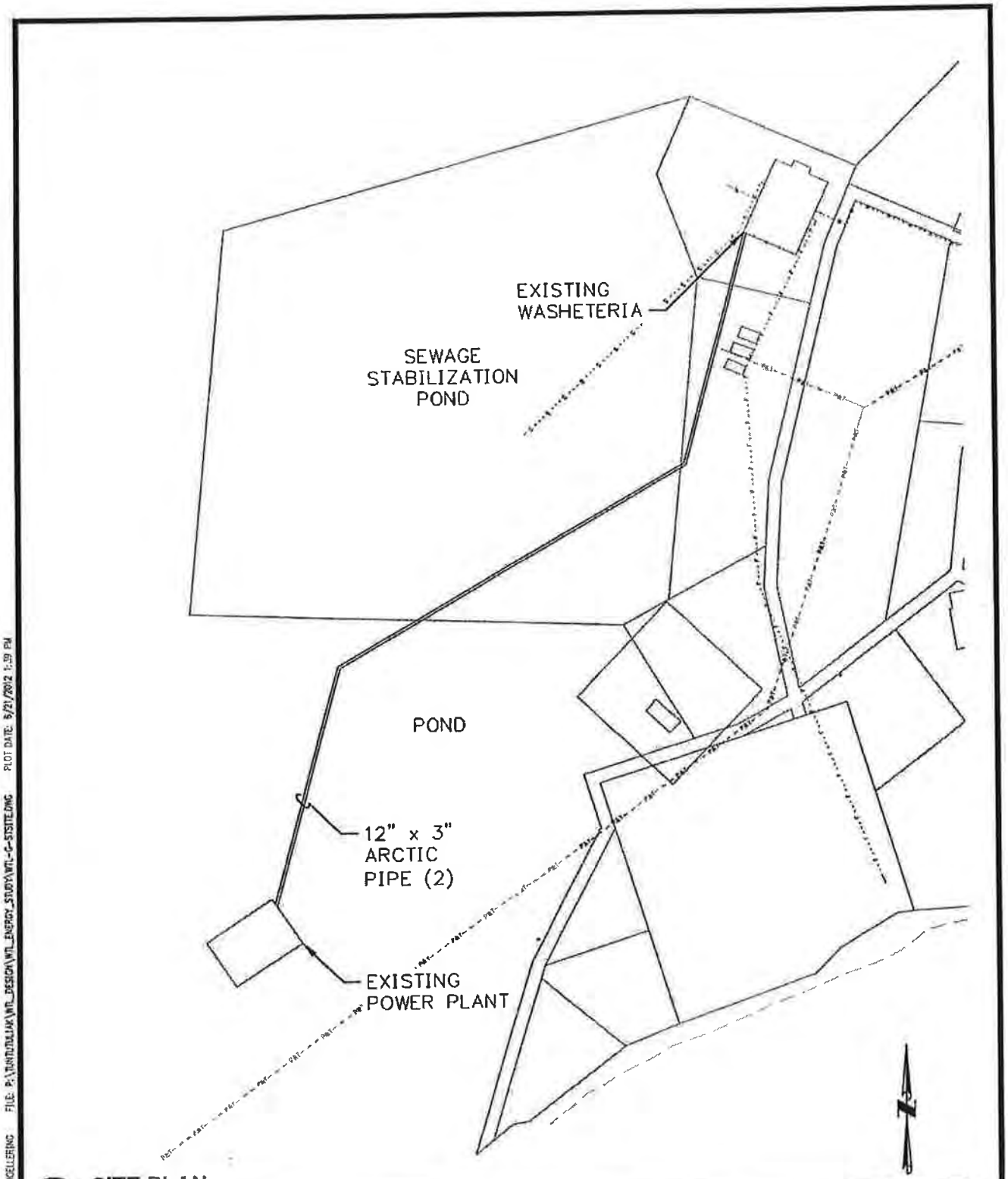

A1 SITE PLAN
NTS

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TUNTUTULIAK, AK
ANTHC RECOVERED HEAT STUDY

DATE:	06-20-2012	LAYOUT:	SITE
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Alaska Native
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DATE: 06-20-2012
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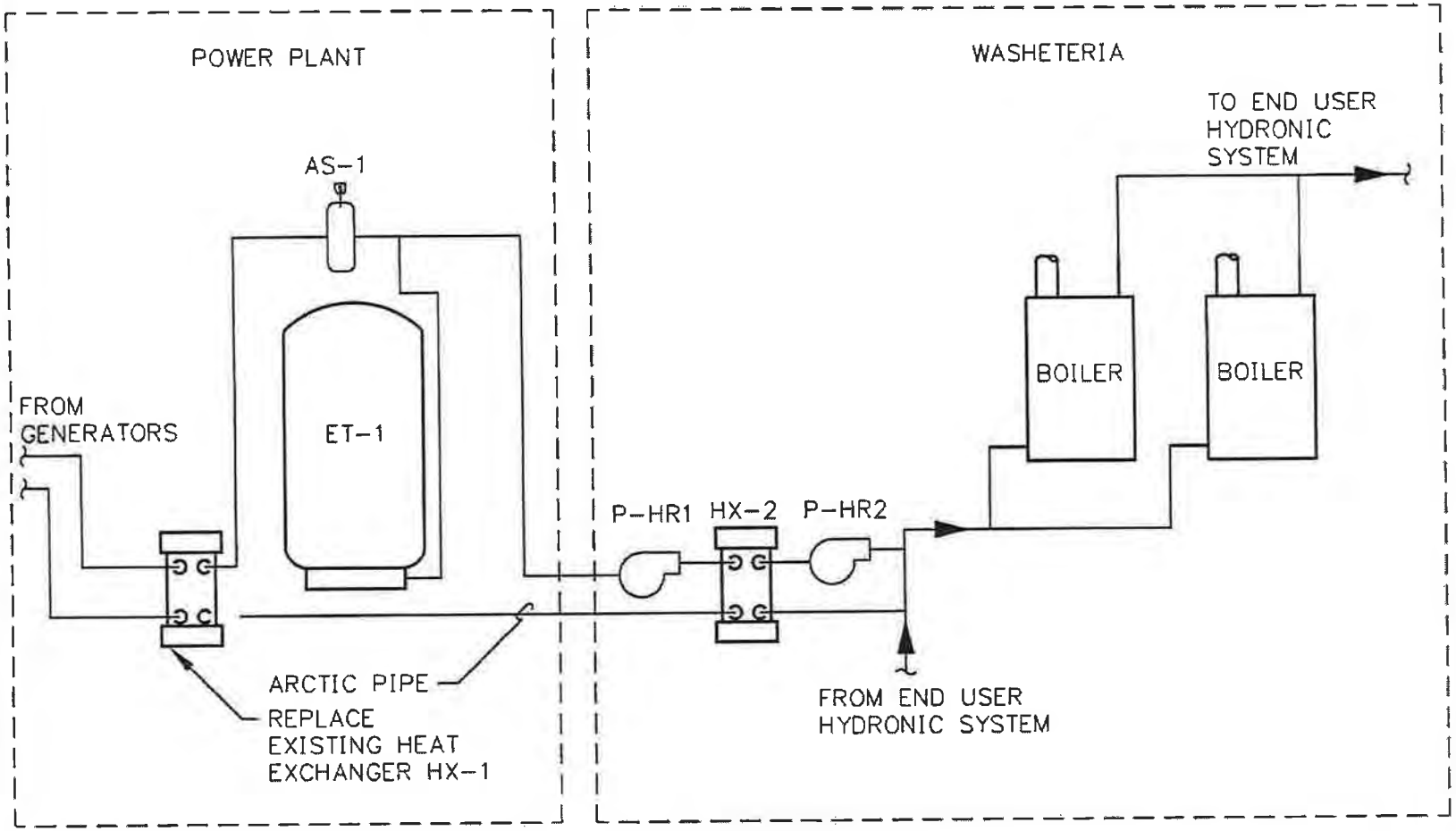
SHEET 4 OF 5

TUNTUTULIAK, AK

ANTHC RECOVERED HEAT STUDY



A1 HEAT RECOVERY PIPING SCHEMATIC
NTS

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TUNTUTULIAK, AK

ANTHC RECOVERED HEAT STUDY

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CHECKED BY:	WF
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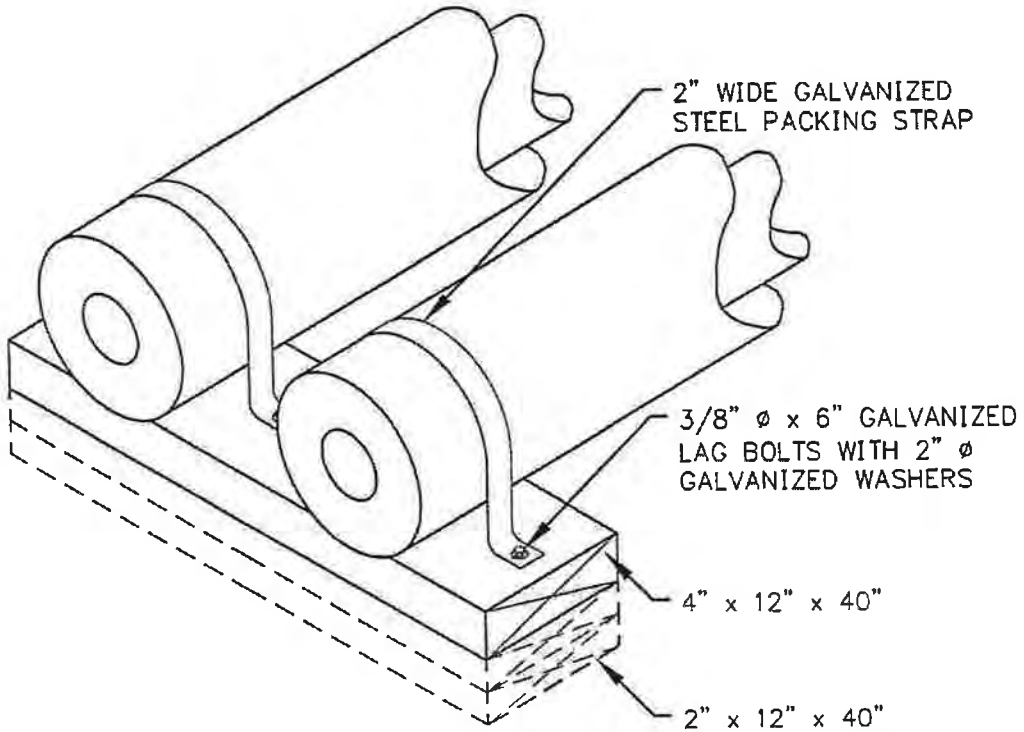
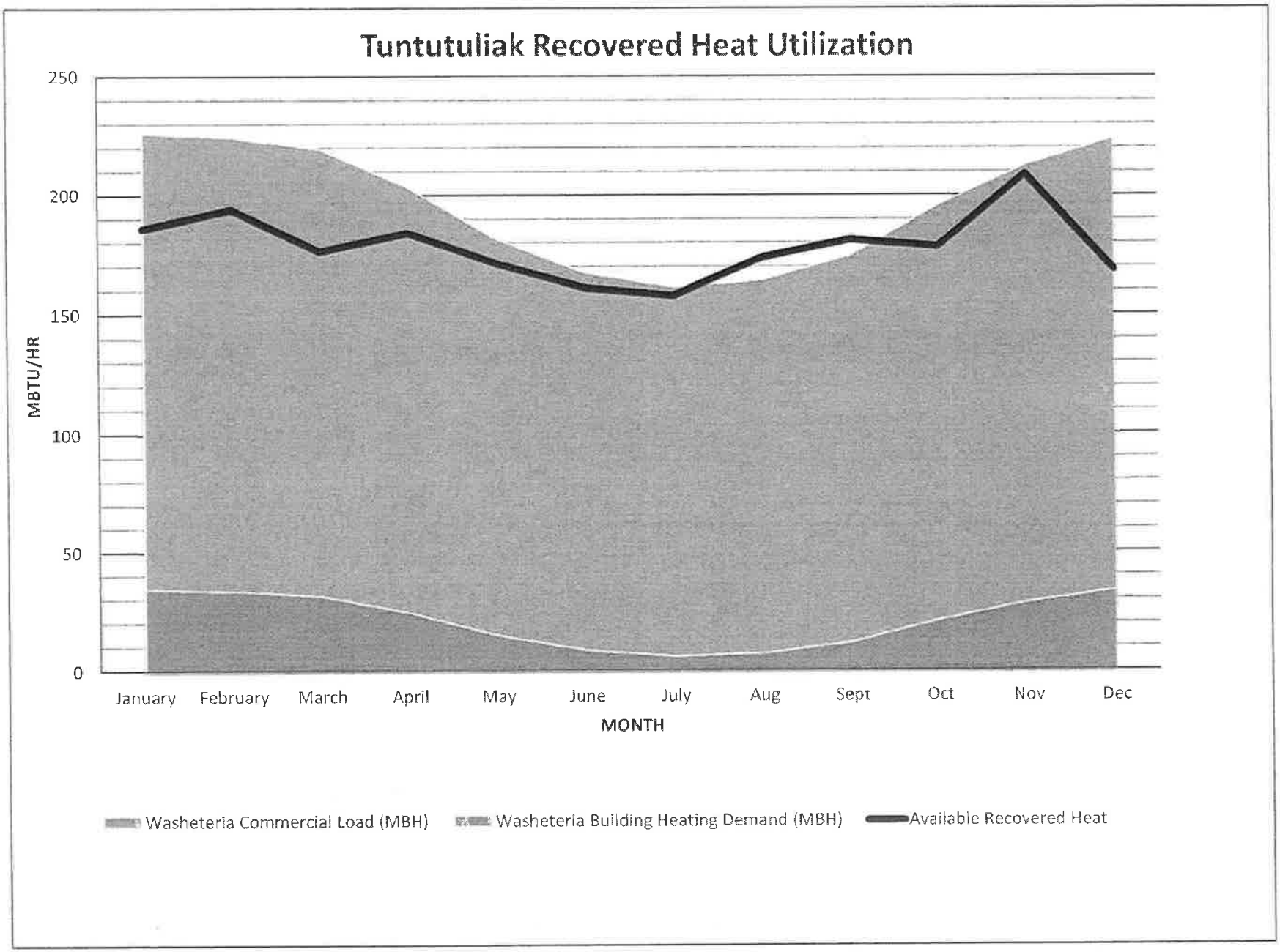
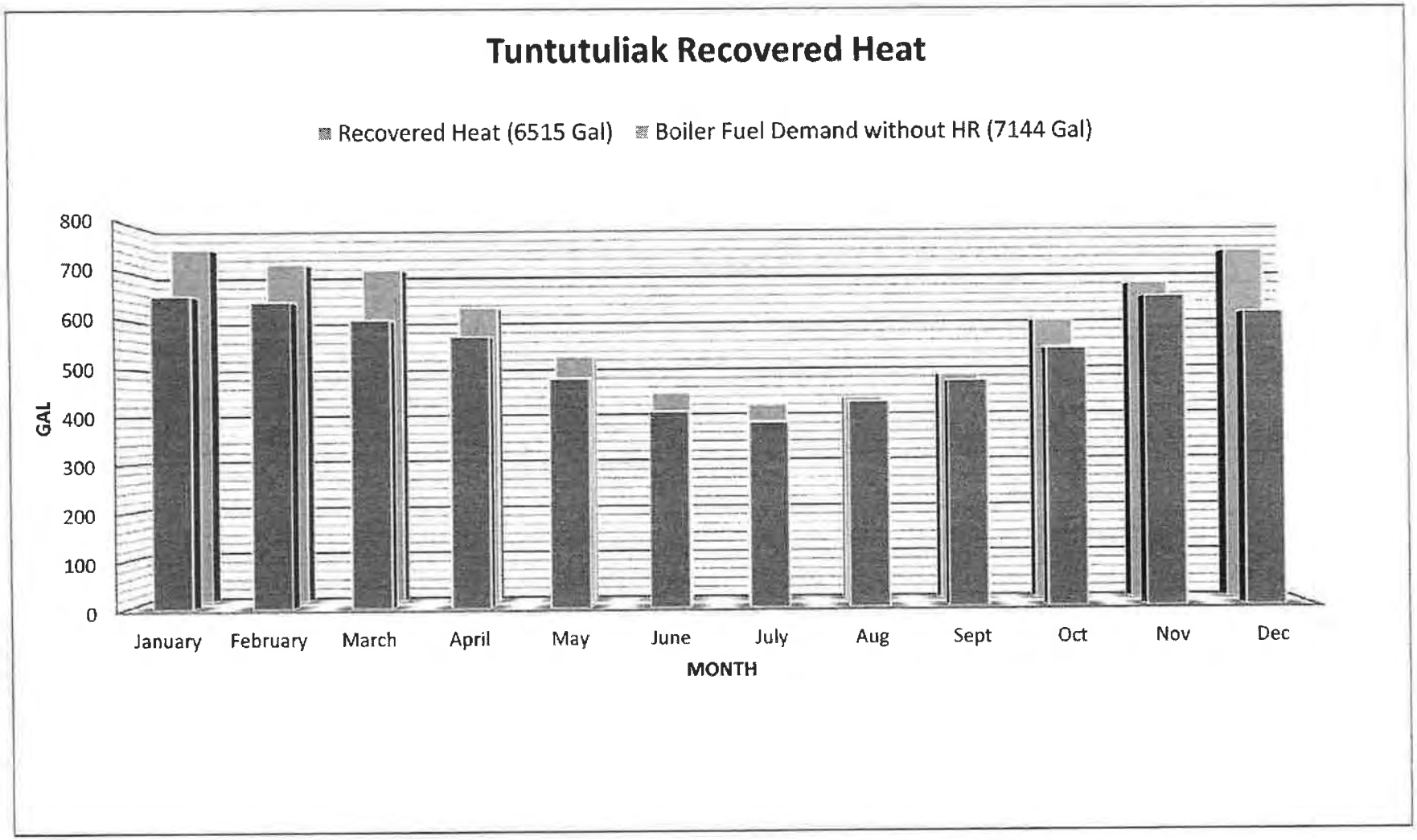


A1 SLEEPERS PIPE SUPPORT
NTS


Tuntutuliak Recovered Heat Utilization
250
200
150
100
50
0
MBTU/HR
January
February
March
April
May
June
July
Aug
Sept
Oct
Nov
Dec
MONTH
Washeteria Commercial Load (MBH)
Washeteria Building Heating Demand (MBH)
Available Recovered Heat


Tuntutuliak Recovered Heat
Recovered Heat (6515 Gal)
Boiler Fuel Demand without HR (7144 Gal)
800
700
600
500
400
300
200
100
0
GAL
January
February
March
April
May
June
July
Aug
Sept
Oct
Nov
Dec
MONTH

Cost Estimate for Heat Recovery Project

Tuntutuliak Heat Recovery Cost Estimate

Tuntutuliak Heat Recovery Cost Estimate

ELEMENT	Production Rate Qty	Production Rate Rate	Days (60hr. Week)	LABOR Super 134	Engineer 126	Operator 117	Mechanic 115	Electrician 127	Plumber 126	shipping 85	Crew Lead 108	Local Labor 35	Local Operator 35	Local Plumber 35	Total Labor
Design															
Civil	80	8	5.0	Fixed estimate @ 120 /hr.											$ 4,800
Mechanical	240	8	30.0	Fixed estimate @ 120 /hr.											$ 28,800
Electrical	88	8	7.0	Fixed estimate @ 120 /hr.											$ 6,720
											Design:	$ 40,320			
			Total hours	327.7	101.1	10.0	14.5	56.2	274.5	22.7	0.0	818.6	5.0	278.2	
Mobilization		*Note													
Equipment Shipping			0.0												$ -
Camp set up	1	1	1.0	3				1	1						$ 6,550
Shop Set up			0.0												$ -
Takeoffs	1	1	1.0	2											$ 2,680
Training	1	1	1.0									1			$ 350
Materials Receiving and Inventory	1	1	1.0	0.5			0.2	0.5	0.5	0.2					$ 2,335
Set up Materials Storage/Yard	1	1	1.0	0.5		1				0.2		2			$ 2,710
Expediting to Const Site			0.0												$ -
															$ -
3" Above Ground Arctic Pipe			0.0												$ -
## of feet	1400	100	14.0	1					1	0.1		2		1	$ 52,290
Bridge Crossing			0.0												$ -
Supports	1400	100	14.0									2			$ 9,800
Road Crossings			0.0												$ -
															$ -
Power Plant connections															$ -
Cooling sys modifications	1	1	1.0		1	0.2				1				1	$ 3,202
HX installation	1	0.3	3.3			0.2				1				1	$ 6,207
Controls	1	1	1.0			0.5		0.5							$ 1,265
Make-up / Expansion Tanks			0.0												$ -
Insulation Upgrades	1	1	1.0											1	$ 350
															$ -
															$ -
Washeteria Connection															$ -
Heating sys modifications	1	0.2	5.0	0.5					1			1		1	$ 13,150
HX installation	1	1	1.0						1	0.1				1	$ 1,695
Controls	1	0.5	2.0					1				1			$ 3,240
Insulation Upgrades	1	1	1.0									1			$ 350
New Hydronic Dryers	3	1	3.0	0.25				0.25	0.25					0.25	$ 3,165
															$ -
															$ -
BTU Meter install															
Connection and install	4	2.3	1.7	0.2				0.5	0.5	0.1		1		1	$ 4,031
Programming and interface	4	2.3	1.7	0.1	1										$ 2,424
															$ -
															$ -
Support Activities															
Surveying	1	1	1.0		1										$ 1,260
Glycol	1	1	1.0							0.2					$ 170
Equipment Maintenance	5	2	2.5				0.4								$ 1,150
Fuel and Lubricants	5	10	0.5				0.5					1	1		$ 638
Fusing Machine	5	8	0.0									1			$ 219
															$ -

MATERIALS

Item	No.	Cost Ea	Total Cost	Freight	Materials + Freight
Site Visit	0	$ 1,100	$ -		
Site Visit	2	$ 1,100	$ 2,200		
Site Visit	1	$ 1,100	$ 1,100		
			$ -		$ -
Rental	30	$ 200	$ 6,000		$ 6,000.00
			$ -		$ -
			$ -		$ -
			$ -		$ -
			$ -		$ -
			$ -		$ -
			$ -		$ -
			$ -		$ -
			$ -		$ -
Pipe	1400	$ 57	$ 79,800	$ 2,000	$ 81,800.00
Fittings	70	$ 120	$ 8,400	$ 600	$ 9,000.00
Materials			$ -		$ -
Clamps/ Ins	70	$ 105	$ 7,350	$ 1,000	$ 8,350.00
					$ -
Pipe & Fittin	1	$ 2,000	$ 2,000	$ 200	$ 2,200.00
HX	1	$ 4,000	$ 4,000	$ 400	$ 4,400.00
Controls	1	$ 275	$ 275	$ 150	$ 425.00
Tank	1	$ 6,500	$ 6,500		$ 6,500.00
Insulation	1	$ 400	$ 400	$ 300	$ 700.00
Air Sep	1	$ 2,500	$ 2,500	$ 300	$ 2,800.00
					$ -
Pipe & Fittin	1	$ 3,050	$ 3,050	$ 200	$ 3,250.00
HX	1	$ 4,000	$ 4,000	$ 400	$ 4,400.00
Controls	5	$ 500	$ 2,500	$ 350	$ 2,850.00
Pump	2	$ 2,000	$ 4,000	$ 150	$ 4,150.00
Dryers	3	$ 1,500	$ 4,500	$ 500	$ 5,000.00
					$ -
BTU Meter	1	$ 4,600	$ 4,600	$ 500	$ 5,100.00
Flow meter	1	$ 3,500	$ 3,500	$ 500	$ 4,000.00
					$ -
			$ -		$ -
Glycol	12	$ 1,150	$ 13,800	$ 3,000	$ 16,800.00
			$ -		$ -
Fuel	250	$ 7	$ 1,750	local	$ 1,750.00
			$ -		$ -

Cost Estimate for Heat Recovery Project

Startup and Operator Training							$ -						$ -
Literature and References	2	1	2.0		1		$ 2,520	Publishing	4	$ 500	$ 2,000	$ 100	$ 2,100.00
Training	1	1	1.0	1	1	2	$ 3,300				$ -		$ -
							$ -						
Job Clean Up/ Final Inspection							$ -				$ -		$ -
Preliminary Clean Up			0.0				$ -				$ -		$ -
Final Inspection Punch List	1	1	1.0	1	1	2	$ 3,300				$ -		$ -
Final Clean Up	2	1	2.0	0.5		2	$ 2,740				$ -		$ -
							$ -				$ -		
De-Mobe							$ -						
Pack Up and Crate	1	1	1.0	3		3	$ 5,070				$ -		$ -
Shipping	1	1	1.0	1		1	$ 1,690				$ -	$ 1,000	$ 1,000.00
							$ -				$ -		
Final							$ -				$ -		$ -
Financial Close out/ Auditing	1	1	1.0		1		$ 1,260				$ -		$ -
As builting	1	1	1.0	1	1		$ 2,600				$ -		$ -
							$ -				$ -		$ -
						Total Labor	$141,711			Total Mat	$ 160,925	M+F total	$172,575.00
						With Design	$185,331						
										Labor + Materials + Freight		$ 314,286	
										Labor + Mat + Frgt + Design		$ 357,906	
										All + contingency		$ 429,487	
										2 years escalation @ 3% / year		$26,155.74	
										Total		$ 455,642	
										Estimated annual savings		$ 44,640	
										Simple Payback (without escalation)		9.6	yrs

Assumptions:
- Local accomodations are avaliable.
- All exterior piping run on sleepers above grade.
- Power plant is mostly configured and equiped.
- System control can be accomplished w/o a panel.
- Crew leader functions will be accomplished by Superontendant, or in lieu of Super.

Benefits to Capital Costs Ratio

Applicant B/C Model

Project Description	
Community	Tuntutuliak
Nearest Fuel Community	Tuntutuliak
Region	Rural
RE Technology	Other
Project ID	WHR for Water System
Applicant Name	
Project Title	
Project Phase	Feasibility

Results	
Total Life time Fuel (Base System)($)	$826,476
Total Life Time Displaced Fuel($)	$0
Total Life Time Displaced WHR($)	$0
NPV Benefits	$826,476
NPV Capital Costs	$442,371
B/C Ratio	1.87
NPV Net Benefit	$384,105

Performance	Unit	Value
Fuel (Base Sys)	gallons per year	7,144
Total Lifetime Fuel (Base Sys)	total lifetime gallons	150,024
Displaced Fuel	gallons per year	6,565
Displaced Total Lifetime Fuel	total lifetime gallons	131,300
Displaced Biomass	Cords per year	250.059
Displaced Biomass	total lifetime Cords	5,751,348

Proposed System	Unit	Value	
Capital Costs	$	$	455,642
Project Start	year		2,015
Project Life	years		20
Displaced Electric	kWh per year		
Existing Heat Demand	gallons displaced per year		7,144
Displaced Heat	gallons displaced per year		6,565
Displaced Transportation	gallons displaced per year		
Renewable Generation O&M	$ per kWh		
Electric Capacity	kW		
Electric Capacity Factor	%		
Heating Capacity	Btu/hr		
Heating Capacity Factor	%		85

Base System	Unit	Value	
Diesel Generator O&M	$ per kWh	$	0.033
Diesel Generation Efficiency	kWh per gallon		13.00

Parameters	Unit	Value	
Heating Fuel Premium	$ per gallon	$	2.85
Transportation Fuel Premium	$ per gallon	$	1.58
Discount Rate	% per year		3%
Crude Oil	$ per barrel		EIA Mid
Natural Gas	$ per MMBtu		ISER - Mid

Benefits to Capital Costs Ratio

Annual Savings (Costs)		Units	2013	2014	2015	2016	2017	2034	2035	PV
Entered Value	Project Capital Cost	$ per year		$ -	$455,642	$ -	$ -	$ -	$ -	$442,371
	Electric Savings (Costs)	$ per year	$0	$0	$0	$0	$0	$0	$0	
	Heating Saving (Costs)	$ per year			$51,207	$51,918	$51,458	$56,793	$57,194	$826,476
	Transportation Savings (Costs)	$ per year	$0	$0	$0	$0	$0	$0	$0	$0
	Total Savings (Costs)	**$ per year**	$0	$0	$51,207	$51,918	$51,458	$56,793	$57,194	$826,476
	Net Benefit	**$ per year**	**$0**	**$0**	**($404,435)**	**$51,918**	**$51,458**	**$56,793**	**$57,194**	**$384,105**

Heating		Units	2013	2014	2015	2016	2017	2034	2035	PV
Proposed										
	Renewable Heat	gallons displaced per year	-	-	6,565	6,565	6,565	6,565	-	131,300
Entered Value	Renewable Heat Scheduled Repai	$ per year	$ -	$ -						$0
Entered Value	Renewable Heat O&M	$ per year								$0
Entered Value	Renewable Fuel Use Quantity (KW	$ per year	250,059	250,059	250,059	250,059	250,059	250,059	250,059	
Entered Value	Renewable Fuel Cost	$ per unit	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
	Remaining Fuel (supplement)	gallons remained	0	0						
	Total Fuel Cost (supplement)	$ per year	0	0	0	0	0	0	0	$0
	Total Renewable Fuel Cost	$ per year	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$0
	Cost of Fuel Displace	$ per year	$ -	$ -						$0
	Proposed Heat Cost	**$ per year**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	$0
Base										
	Fuel Use	gallons per year	-	-	7,144	7,144	7,144	7,144	7,144	
	Fuel Cost	$ per gallon	$ 6.80	$ 7.03	$ 7.17	$ 7.27	$ 7.20	$ 7.95	$ 8.01	
Entered Value	Fuel Scheduled Repairs	$ per year	$ -	$ -						$0
Entered Value	Fuel O&M	$ per year	$ -	$ -						$0
	Fuel Cost	$ per year	$ -	$ -	$ 51,207	$ 51,918	$ 51,458	$ 56,793	$ 57,194	$826,476
	Base Heating Cost	**$ per year**	**$ -**	**$ -**	**$ 51,207**	**$ 51,918**	**$ 51,458**	**$ 56,793**	**$ 57,194**	$826,476

Heat Recovery Utilization Simulation Work Sheet

ANTHC DEHE

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Division of Environmental Health & Engineering

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(907) 729-3579

FAX (907) 729-4046

e-mail: cpark@anthc.org

ject Name: **Tuntutuliak Heat Recovery Project**

ct Number: **TBD**

Engineer: **CP** Checked: _____

ision Date: **04-Jun-12**

Print: **7-Apr-13**

File: C:\Documents and Settings\cpark\Chong\Energy\Feasibility Studies\Tuntutuliak\[Tuntutuliak_HR_Feasibility_Calcs_Rev XLSX]Calcs

Find: Feasibility of Heat Recovery from Tuntutuliak Generator Facility to existing Washeteria

Given: Monthly KWH produced by existing generator plant in 2011 (PCE Data)
Heating Degree days for Tuntutuliak

Washeteria reported Fuel consumption 7100 Gal / Year

Assumptions:

Design Air Temperature:	-40 Deg F
Design Water Temperature	40 Deg F
Washeteria Space Temperature	70 Deg F
HR Piping will be above grade in Arctic Pipe	
1740 BTU to radiators / KW Power Generated (250 KW) (@ part load)	1,740 Btu/KWh
1503 BTU to radiators / KW Power Generated (250 KW) (@ full load per John Deer Engine Data)	1,503 Btu/KWh
Plant will not charge for Recovered Heat	
Heat loss per below calculations	
Heat loads per below calculations	
Raw water production occuring in summer months only (seasonal water supply)	
Above Ground Heat Recovery System in Arctic Pipe	

Estimated peak heat loss for Washeteria	65,000 BTU/Hr
Estimated peak Washeteria Dryer Airflow	900 CFM
Estimated Dryer Air Temperature	180 Deg F
Estimated peak Washeteria Hot water load	82,500 BTU/Hr (40 GPH x 3)
Estimated Boiler AFUE:	60% (Boilers in poor shape)
Community Estimated Fuel Price:	$6.80 per gal
Estimated Fuel Price	$6.80 per gal
Heat Sales Agreement:	0% Avoided fuel cost (Village Owned Power)

Calculations:

Parasitic Generator Cooling System Losses	
Design Air Temperature:	-40 Deg F
AMOT valve leak Rate (average)	1 GPM
Hot CoolantTemperature	180 Deg F
Design Heat Loss:	18180 BTU/Hr
Heat loss / Degree of OSA temp:	82.6

Above Ground Heat Recovery Pipe Heat Loss:		
Design Heat Recovery loop Temperature	180	Degrees F
Design Air Temperature:	-40	Degrees F
Insulation:	3.5	Inch foam ins.
Pipe:	3	Pipe OD (Inches)
Insulation K value	0.16	BTU x in / (ft^2 x hr x Deg F)
R value =	14.372	Ft^2 x hr x Deg F
Length of Above ground Pipe	1400	Ft
Design Heat Loss:	16,831	BTU/hr
Heat Loss / Degree OSA temp	76.5	

Generator Module Heat Loads		
The heating		
Living quarters design heat loss		0 BTU/Hr
Control module Heat Loss		0 BTU/Hr
Storage modules Heat Loss		0 BTU/Hr
Generator Modules Heat Loss		0 BTU/Hr
	Total	0 BTU/Hr
Heat loss / degree of OSA temp:		0 BTU/Hr* deg F

Heat Recovery Utilization Simulation Work Sheet

ANTHC DEHE

Division of Environmental Health & Engineering

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e-mail: cpark@anthc.org

ject Name: **Tuntutuliak Heat Recovery Project**
ct Number: **TBD**
Engineer: **CP** Checked: _____
ision Date: **04-Jun-12**
Print: 7-Apr-13

File: C:\Documents and Settings\cpark\Chong\Energy\Feasibility Studies\Tuntutuliak\[Tuntutuliak_HR_Feasibility_Calcs_Rev.XLSX]Calcs

Calculations (Continued)

Raw Water Heating Load		
Raw water anticipated flow rate	6	GPM
Raw water temperature:	35	Deg F
Treatment Process Temperature	37	Deg F
Raw water **heating** load:	6000	BTU /Hr

Existing Washeteria Heat Loss:		
Building design heating loss:	65,000	BTU/H
Heat loss / degree of OSA temp	590.9	BTH/H* Deg F

Washeteria Commercial Loads

Washeteria Loads reflect operation for 8 hours a day, 5 days a week, with average load at 80% of design. It's worth noting that loads will approach 100% of design if users from St. Michael come to Stebbins for cheaper laundry use.

Peak Washer Load (for waste heat capacity estimation:	
Peak Dryer load (for waste heat capacity estimation):	214,830 BTUH
Service Factor	70%
Dryer load per Design degree day (with service Factor)	752 BTUH/DegF
Hot water load (with service factor)	57750 BTUH
Average hours per month (for fuel savings estimation:	160

Powerplant Available Recovered Heat Estimate

Month	KWH / Month	Days / Month	Av KW	Minimum Engine KW with Wind	Average KW to Electric Boiler	Htg Degree Days / Month (40F)	Htg Degree Days / Month (60F)	Htg Degree Days / Month (180F)	Available heat (No Wind) MBH	Available Heat (Max Wind) (MBH)	Parasitic Cooling System Losses (MBH)	Estimated Available Heat (MBH)
January	94882	31	128	60	30	1,187	1,807	5,527	222	207	15	**200**
February	95016	29	137	60	30	1,072	1,652	5,132	238	207	15	**207**
March	83320	30	116	60	30	1,003	1,603	5,203	201	207	14	**190**
April	88096	30	122	60	30	642	1,242	4,842	213	207	13	**196**
May	77834	31	105	60	30	158	778	4,498	182	207	12	**182**
June	65403	30	91	60	30	-	435	4,035	158	207	11	**171**
July	64159	31	86	60	30	-	310	4,030	150	207	11	**168**
Aug	77992	31	105	60	30	-	375	4,095	182	207	11	**184**
Sept	82769	30	115	60	30	-	594	4,194	200	207	12	**192**
Oct	85173	31	114	60	30	484	1,104	4,824	199	207	13	**190**
Nov	109364	30	152	60	30	846	1,446	5,046	264	207	14	**222**
Dec	79701	31	107	60	30	1,132	1,752	5,472	186	207	15	**182**

Heat Recovery Utilization Simulation Work Sheet

ANTHC DEHE

Alaska Native Tribal Health Consortium

Division of Environmental Health & Engineering

3900 Ambassador Dr. Suite 301
ANCHORAGE, AK 99508
(907) 729-3579
FAX (907) 729-4046
e-mail: cpark@anthc.org

ject Name: **Tuntutuliak Heat Recovery Project**
ct Number: **TBD**
Engineer: **CP** Checked: _____
ision Date: **04-Jun-12**
Print: **7-Apr-13**

File: C:\Documents and Settings\cpark\Chong\Energy\Feasibility Studies\Tuntutuliak\[Tuntutuliak_HR_Feasibility_Calcs_Rev.XLSX]Calcs

Recovered Heat Transmission Losses:

Month	Generator Facility Heating load (MBH/Hr)	Above Ground Pipe Loss (MBTUH)	Sum Transmission Losses (MBTUH)
January	-	14	14
February	-	14	14
March	-	13	13
April	-	12	12
May	-	11	11
June	-	10	10
July	-	10	10
Aug	-	10	10
Sept	-	11	11
Oct	-	12	12
Nov	-	13	13
Dec	-	14	14

Available Recovered Heat

Month	Estimated Available Heat for recovery (MBH/ Hr)	Raw Water Heat Add (MBH /Hr)	Washeteria Building Heating Demand (MBH)	Washeteria Commercial Load (MBH)	Total Heat Demand (MBH)	Recovered Heat Benefit (MBH)
January	186	6	34	192	232	186
February	194	6	34	191	230	194
March	176	6	32	188	226	176
April	184	6	24	179	210	184
May	171	6	15	167	188	171
June	161	6	9	159	173	161
July	158	6	6	155	167	158
Aug	174	6	7	157	170	170
Sept	181	6	12	163	181	181
Oct	178	6	21	175	202	178
Nov	209	6	28	184	219	209
Dec	168	6	33	190	230	168

Washeteria Commercial Loads

Building Heat Loss	Dryer Load (MBH)	Washer Load (MBH)	Total (MBH)
34	134	57.75	226
34	133	57.75	224
32	130	57.75	220
24	121	57.75	204
15	109	57.75	182
9	101	57.75	167
6	98	57.75	161
7	99	57.75	164
12	105	57.75	175
21	117	57.75	196
28	126	57.75	213
33	133	57.75	224

Estimated Fuel Savings

Month	Washeteria Estimated Fuel Demand (Gal)	Recovered Heat Avoided Fuel Use (Gal)	Recovered Heat Avoided Fuel Cost (Dollars)	Recovered Heat Charges (Dollars)	Savings to Community (Dollars)
January	756	664	$4,514	$0	$4,514
February	723	650	$4,423	$0	$4,423
March	711	613	$4,167	$0	$4,167
April	629	579	$3,934	$0	$3,934
May	525	492	$3,347	$0	$3,347
June	447	422	$2,868	$0	$2,868
July	420	400	$2,722	$0	$2,722
Aug	434	434	$2,953	$0	$2,953
Sept	483	483	$3,282	$0	$3,282
Oct	598	551	$3,747	$0	$3,747
Nov	675	656	$4,458	$0	$4,458
Dec	744	621	$4,226	$0	$4,226
	7144	6565	$44,640	$0	$44,640

Department of Commerce, Community, and Economic Development
COMMUNITY DATABASE ONLINE

QUARTERLY REPORT: 2014, OCTOBER - DECEMBER (Q2), TUNTUTULIAK

Community:	Tuntutuliak
Staff:	Ken Berlin
DCRA Regional Office:	Bethel
Gov't Type:	Federally Recognized Tribe
Borough:	
Agreement?	No
Agreement Date:	
Entity:	Native Village of Tuntutuliak
Population:	399 (2012 Alaska Department of Labor Estimate)
Assessment Status:	Assessment Completed
Assessment Date:	11/21/2013
Exp Date:	
Last Updated:	

Community Sanitation Overview:

Through a memorandum of agreement with Tuntutuliak Community Services Association, Tuntutuliak Traditional Council operates the washeteria, water treatment plant, flush tank haul system, honeybucket haul and landfill/lagoon site. There is garbage collection services provided. Most of the homes have access to the wastewater pump-out and water delivery services. Fourteen homes still have to be connected to the flush haul system. The connection of the homes to the system is curently on hold. The school has a well and wastewater lagoon and is in the process of upgrading their treatment plant. Tuntutuliak Community Services Association operates the local electrical services.

RUBA Status & Activities This Qtr:

RUBA staff assisted the administrator for the Tuntutuliak Traditional Council September 4 when she requested a sample water and wastewater ordinance. Staff sent a sample for her to use to draft one for the council's consideration. RUBA staff traveled to Tuntutuliak on October 14-16 and conducted a RUBA management assessment; the report was finalized on November 20, 2013. The Tuntutuliak Traditional Council does not have an overall CY2013 budget nor any finance reports. The utility has an adequate fuel supply to last until the next spring barge delivery. The utility has a credit on their electric bill for September 2013. The utility has a water wastewater policy with a collection policy, but it is not enforced. Utility customers are not being billed but get serviced on a prepay basis. The IRS confirmed compliance on October 29, 2013 and the State DOL/ESC confirmed compliance to September 2013. The utility is covered by Alaska National Insurance Company from January 15, 2013 to January 15, 2014. Tuntutuliak Traditional Council hired a new administrator on June 3, 2013 and she needs more training on the operation and maintenance of the utility. The bookkeeper was hired in September 2012 but she needs more training in QuickBooks. The utility operator's position is currently vacant and a job opening has been posted. The Tuntutuliak Traditional Council is lacking CY13 budget, finance reports, revenue generation, enforcement of collection policy, monthly billings, accounts receivables, trained manager, bookkeeper, and certified water operators. The water operators need to work towards necessary certification, and develop a preventive maintenance plan. There is a grant to update the 1993 master plan and the renovation to the old washeteria is to resume in the next couple of months according to DEC staff trip report dated November 5-7, 2013.

RUBA Activities for the Coming Qtr:

RUBA staff to develop a workplan and training for the utility manager and bookeeper. The workplan and training will consist of the following: a realistic balanced CY2014 budget; development of a financial reporting format; update the billings and collections policies and procedures and enforcement of; set up accounts/ledgers for each accounts receivables including water and wastewater accounts; and to hire competent water operators capable of working towards necessary certification to run the water treatment plant and wastewater system.

Scores:

Essential Indicators:	14 of 27
Sustainable Indicators:	13 of 27
Total Score:	27 of 54

Finances

Essential Indicators

Answer	Question
No	All revenues and expenses for the utility are listed in the utility budget.
No	The utility has adopted a balanced realistic budget.
No	Monthly financial reports are prepared and submitted to the policy making board.
Yes	The utility is current in paying all water/wastewater electric bills.
Yes	The utility has on hand a year's adequate fuel supply or it has a financial plan to purchase an adequate supply.
No	The utility is receiving revenues (user fees or other sources) sufficient to cover operating expenses.

Sustainable Indicators

Answer	Question

No	The utility is receiving revenues (user fees or other sources sufficient to cover operating expenses and Repair & Replacement (R) costs.
No	YTD revenues are at a level equal to or above those budgeted.
No	YTD expenditures are at a level equal to or below those budgeted.
Yes	A monthly manager's report is prepared.
No	Budget amendments are completed and adopted as necessary.

Finances Comments

A realistic budget continues to be non-existent for this organization, also there are no finance reports. The finance report generated from QuickBooks was not accurate due to mistakes inputting data and there were no reconciliations. The manual finance report produced did not have any budget figures because the council does not have an overall budget. The September 2013 electric bill from Tuntutuliak Community Services Association has a credit balance. The Tuntutuliak Traditional Council ordered and received its fuel order for the winter. The utility is not receiving sufficient revenue but is heavily subsidized through the general fund account. Without a budget and budget vs. actual financial report, it is not possible to determine how much the utility is subsidized. The manager does oral reports to the council; RUBA staff recommended written reports.

Accounting Systems

Essential Indicators

Answer	Question
No	The utility has adopted a collection policy and actively follows it.
No	The utility bills customers on a regular basis.
No	An accounts receivable system is in place which tracks customers and reports past due accounts and amounts.
Yes	An accounts payable system is in place.
Yes	The payroll system correctly calculates payroll and keeps records.
Yes	A cash receipt system is in place that records incoming money and how it was spent.
Yes	The utility has a cash disbursement system that records how money was spent.

Sustainable Indicators

Answer	Question
Yes	A chart of accounts is used that identifies categories in a reasonable, usable manner.
No	Monthly bank reconciliations have been completed for all utility accounts.
No	The utility has a purchasing system that requires approval prior to purchase, and the approval process compares proposed purchases to budgeted amounts.

Accounting Systems Comments

The utility does have a water and wastewater ordinance with a collection policy but is not enforcing it and the ordinance needs to be updated. The customers are not billed for honeybucket haul, but the customers with CoWater wastewater haul systems are serviced on a prepay basis at the rate of $67 per delivery for water and wastewater haul. The washeteria/water treatment plant has four washers but only two work and three dryers with two working. There are two showers but only one works. Both the water and wastewater haul equipment need new tires. The QuickBooks Pro system needs to be updated along with the computer system. Accounting is done with both, QuickBooks and manually. The QuickBooks needs to be set up correctly and reconciled. A survey needs to be done to determine which customers are on the honeybucket and CoWater system.

Tax Problems

Essential Indicators

Answer	Question
Yes	The utility has a system to accurately calculate, track, and report payroll tax liabilities.
Yes	The utility is current on filing tax reports.
Yes	The utility is current on making tax deposits.
Yes	If there are any past due tax liabilities or recorded tax liens, a lien release has been issued or a repayment agreement has been signed and repayments are current.

Tax Problems Comments

The Tuntutuliak Traditional Council uses QuickBooks to process payroll and make payroll tax deposits. The IRS confirmed compliance on October 29, 2013 and the State DOL/ESC confirmed compliance to September 2013. The utility uses QuickBooks to do their payroll and file their IRS and State DOL quarterly reports and do deposits. The Tuntutuliak Traditional Council has three active EIN numbers, it was recommended to close two and use only one EIN.

Personnel System

Essential Indicators

Answer	Question
Yes	The utility has a posted workers compensation insurance policy in effect.

Sustainable Indicators

Answer	Question
Yes	The utility has adopted and uses a Personnel Policy, which has been reviewed by an attorney, AML or Commerce for topics and language.
Yes	The utility has adequate written job descriptions for all positions.
Yes	The utility has adopted and follows a written personnel evaluation process that ties the job description to the evaluation.
Yes	The utility has an adequate written hiring process.
No	The utility has personnel folders on every employee that contain at least: I-9, Job Application and Letter of

	Acceptance.
Yes	The utility has a probationary period for new hires that includes orientation, job training/oversight, and evaluations.
Yes	The utility provides training opportunities to staff as needed and available.

Personnel System Comments

The utility is covered by Alaska National Insurance Company from January 15, 2013 to January 15, 2014. The utility has a personnel policy which covers all staffing, performance expectations, computer/network use, compensation, benefits, reimbursement for expenses, employee relations, discipline, and training and development. The utility has a Native Preference hiring policy, but it also has an Equal Opportunity section. The administrative and finance staff are hired by the council and all other employees are hired by the administrator. All applicants for employment must fill out an application before being considered. There is a three months probationary period. Evaluations are completed after the three months probationary period and annually on the date of hire. The utility employees all have personnel folders but are lacking I-9 forms.

Organizational Management

Essential Indicators

Answer	Question
Yes	The entity that owns the utility is known; the entity that will operate the utility is set.
Yes	The policy making body is active in policy making of the utility.
No	The policy making body enforces utility policy.
No	The utility has an adequately trained manager.
No	The utility has an adequately trained bookkeeper.
No	The utility has an adequately trained operator or operators.
Yes	The utility has adopted the necessary ordinances (or rules and regulations) necessary to give it the authority to operate.

Sustainable Indicators

Answer	Question
Yes	The utility has adopted an organizational chart that reflects the current structure.
Yes	The policy making body meets as required.
Yes	The utility complies with the open meeting act for all meetings.

Organizational Management Comments

The utility is owned by the Tuntutuliak Traditional Council and is known by the community members. The administrative and finance staff have a high turnover rate. A new administrator was hired in June 2013 and she needs more training on the operation and maintenance of the utility. She has some prior experience in administrative and accounting work. The bookkeeper was hired in September 2012 but she needs more training in QuickBooks. The bookkeeper has about ten months experience working as a bookkeeper using QuickBooks for the Qinaq Corporation store. She also attended Indian Tribal Government payroll tax training. The existing utility ordinance needs to be updated and sample water and wastewater utility ordinance was sent in September 2013, but amendments have not been adopted yet. The utility board needs to give more support to the manager when it comes to adopting and enforcing policy. The Tuntutuliak Traditional Council has an organizational chart in place and the policy making board meets as required and complies with the Open Meeting Act.

Operation of Utility

Essential Indicators

Answer	Question
No	The utility operator(s) are actively working towards necessary certification.
No	The utility has a preventative maintenance plan developed for the existing sanitation facilities.

Sustainable Indicators

Answer	Question
No	The manager receives a monthly O&M report from the utility operator and routinely "spot checks" the facilities to see that the maintenance items are being completed.
No	The utility has a safety manual and holds safety meetings.
Yes	Utility facilities have not suffered any major problems/outages due to management issues that are unresolved.
No	The utility is operating at the level of service that was proposed.
No	The operator provides status reports to the manager on a routine basis.
Yes	The utility has completed and distributed its "Consumer Confidence Report".
No	The utility is not on the "Significant Non-Complier" (SNC) list.
No	The utility maintains an inventory control list.
No	The utility maintains a critical spare parts list.

Operation of Utility Comments

The utility operator's position is currently vacant and a job opening has been posted. The substitute operator is covering the position now but he is not certified. The washeteria/water treatment plant was built in the early 1980's. It was being renovated recently by CRW but work was stopped due to lack of funding. Another grant was obtained by DEC to complete the renovation in November 2013. A preventative maintenance plan, O&M reports, safety manual, inventory control list, and critical spare parts list were not available or not located. At the time of the October 2013 trip, the water and wastewater operator's position was vacant. The water treatment plant is on the SNC list for October 2013. The Bethel regional office has a copy of the current CCR.

Best Practices Score
Tuntutuliak
FALL 2018

Category		O&M Scoring Criteria	Possible	Score	Explanation of Score	How to Improve Score	Contact
Technical	**Operator Certification**	Utility has more than one operator certified to the level of the water system	10	3	System Classification: Water Treatment 1 Primary Operator: *Thomas Friendly* Certification Level: *Small Treated* Backup Operator: *Charlie Lupie* Certification Level: *Small Treated* Thomas Friendly and Charlie Lupie hold certifications but not at the correct level.	Thomas Friendly, John White, and Charlie Lupie need to pass the WT1 exam. Please see the enclosed flier with more information about certification.	ADEC Operator Certification Program 465-1139
		Primary operator is certified to the level of the water system and the backup operator holds some level of certification in water treatment or distribution	7				
		Primary operator is certified to the level of the water system and the backup operator holds no certification or there is no backup operator	5				
		Utility has one or more operators certified at some level in water treatment or distribution	3				
		Utility has no certified operators	0				
	Preventive Maintenance Plan	Utility has a written PM plan; PM is performed on schedule; records of completion are submitted on a quarterly basis and have been verified	25	15	The utility is not performing the required maintenance or isn't keeping records of maintenance.	To receive the full points in this category, the operator must have a Preventative Maintenance plan that they follow and the completed plan must be submitted to your assigned RMW each quarter.	Bob White YKHC RMW 543-6428
		Utility has a written PM plan; performance of PM and record keeping are not consistent	15				
		Utility has no PM plan or performs no PM	0				
	Compliance	Utility had no Monitoring and Reporting violations during the past year	10	0	The utility had 6 Drinking Water Monitoring and Reporting violations in 2017.	The Drinking Water Program provides you with an Annual Monitoring Summary with all of the required samples for your water system. All samples and reports must be collected and submitted in a timely manner.	Chris Secary ADEC Drinking Water Program 269-7518
		Utility had up to five Monitoring and Reporting violation during the past year	5				
		Utility had more than five Monitoring and Reporting violation during the last year	0				
Managerial	**Utility Management Training**	A person who holds a position of responsibility for management of the utility has completed a DCRA approved Utility Management course or other utility management training course within the last five years	5	5	Deanna White attended elected officials training on 2/27/2015.	To maintain the full points in this category, consider sending someone to one of the free RUBA trainings each year.	Ben Balivet DCRA RUBA Program 269-4547
	Meetings of the Governing Body	The utility owner's governing body meets routinely consistent with the local ordinance/bylaw requirements and receives a current report from the operator	5	2	2018 March, April and May meeting minutes were provided. All three lacked monthly financial reports and only May had a water operator's report. None of these reports were signed by the tribal president, tribal administrator nor clerk.	To receive additional points, provide RUBA with meeting minutes that demonstrate that the operator is providing a report to the council.	
		The utility owner's governing body meets routinely consistent with the local ordinance/bylaw requirements	2				
		The utility owner's governing body does not meet	0				
Financial	**Budget**	Utility owner and the Utility have each adopted a realistic budget and budget amendments are adopted as needed; Accurate monthly budget reports are prepared and submitted to the governing body	15	0	An adopted, realistic budget has not been submitted to RUBA.	Provide RUBA with an adopted, realistic budget. Provide RUBA with monthly financial reports and meeting minutes that demonstrate the council is reviewing the monthly financial reports.	
		Either the Utility or the Utility owner has adopted and implemented a budget, the other has not	13				
		Either the Utility or the Utility owner has adopted a budget, but it is not being implemented	10				
		Utility owner and the Utility have not adopted a budget	0				
	Revenue	Utility is collecting revenue sufficient to cover the Utility's operating expenses and to contribute to a repair and replacement account	20	0	No fee schedule nor collection policy has been provided to RUBA.	Provide RUBA with the utility's fee schedule and collection policy. RUBA can assist in developing these if none exist.	
		Utility is collecting revenue sufficient to cover expenses	15				
		Utility has a fee schedule and a collection policy that is followed	5				
		Utility has no fee structure or collection policy	0				
	Worker's Compensation Insurance	Utility has had a worker's compensation policy for all employees for the past two years and has a current policy in place	5	5	Current policy verified 7/11/2018.	Full points have been awarded. Maintain active Worker's Compensation policy to continue receiving these points.	
		Utility has a current worker's compensation policy in place for all employees	2				
		Utility has no worker's compensation policy	0				
	Payroll Liability Compliance	Utility has no past due tax liabilities and is current with all tax obligations	5	0	No IRS return has been filed for 3/31/2018.	To receive additional points in this category, the utility must either become current on all outstanding tax liabilities, or must enter into a repayment agreement for outstanding tax liability, and remain current on payments.	
		Utility owes back taxes, but has a signed payment agreement, is current on that agreement, and is up-to-date with all other tax obligations	2				
		Utility is not current with its tax obligations and/or does not have a signed repayment agreement for back taxes owed	0				
CIP O&M Score	0	SDS O&M Score	5	TOTAL SCORE	30		

Appendix D: Cost Estimating

Contents:

- Project Cost Estimates
- Life Cycle Cost Estimates
- Alternatives' Cost Summary
- Alternative page 33, SDS Format Insert
- SDS Cost Breakdown

Construction (Capital) Costs				
Item	No.	Unit	Cost	Total
Mob & Demo	1	LS	$1,000,000	$1,000,000
Construction Survey	1	LS	$5,000	$5,000
Boardwalk & Board Parking	500	SQFT	$20	$10,000
Site Electrical	1	LS	$5,000	$5,000
Access Ramp	1	LS	$20,000	$20,000
Stick-Built Expansion	844	SQFT	$500	$422,000
Repair and Expand Foundation	1	LS	$150,000	$150,000
Washeteria Interior Remodel	1	LS	$200,000	$200,000
Washeteria Exterior Remodel	1	LS	$100,000	$100,000
Washeteria Equipment	1	LS	$50,000	$50,000
WTP- Equipment	1	LS	$200,000	$200,000
WTP-Piping & Valve Replacement	1	LS	$30,000	$30,000
WTP-HVAC	1	LS	$60,000	$60,000
Power Plant Waste Heat	1	LS	$513,000	$513,000
Emergency Generator	1	LS	$12,000	$12,000
Day Tank	1	LS	$8,000	$8,000
Tank Foundation-Gravel	600	CYD	$100	$60,000
Tank Foundation-Thermal Syphons	1	LS	$45,000	$45,000
New Water Storage Tank	1	LS	$300,000	$300,000
Yard Piping	1	LS	$10,000	$10,000
New Outfall Piping	200	FT	$400	$80,000
New Raw Water Piping	0	FT	$200	$0
Water Haul Trailer	1	LS	$20,000	$20,000
Commissioning	1	LS	$10,000	$10,000
O&M Manual & Training	1	LS	$10,000	$10,000
O&M Equipment	1	LS	$2,500	$2,500
			Subtotal	$3,322,500
Resident Project Representative	8%	of	$3,322,500	$265,800
Construction Administration	12%	of	$3,322,500	$398,700
Project Administration	12%	%	$3,322,500	$398,700
			Subtotal	$1,063,200
Total	$4,385,700			

Non-Construction Costs				
Item	No.	Unit	Cost	Total
Survey	1	LS	$10,000	$10,000
Geotechnical	1	LS	$60,000	$60,000
Land Acquisition/ROW	1	LS	$5,000	$5,000
Engineering	14%	of	$3,322,500	$465,150
Permitting	1	LS	$15,000	$15,000
Project Contingency	20%	of	$3,322,500	$664,500
Total	$1,219,650			

Operations & Maintenance Costs (Annual)				
Item	No.	Unit	Cost	Total
WTP Personnel	1,500	HR	$30	$45,000
Washeteria Personnel	3,120	HR	$15	$46,800
Water Haul Personnel	676	HR	$30	$20,280
Administrative Costs	1	LS	$10,000	$10,000
Disposable Materials	1	LS	$6,000	$6,000
Workman's Comp	52.96	100 HR	$3	$146
Insurance (bldg, general)	1	LS	$2,000	$2,000
Heating Costs (oil fuel)	1	LS	$45,000	$45,000
Energy Costs (electric)	1	LS	$8,000	$8,000
Total	$183,226			

Item	Cost
Construction (Capital) Costs	$4,385,700
Non-Construction Costs	$1,219,650
Total Costs	$5,605,350
O&M Costs (Annual)	$183,226

Construction (Capital) Costs				
Item	No.	Unit	Cost	Total
Mob & Demo	1	LS	$1,000,000	$1,000,000
Construction Survey	1	LS	$10,000	$10,000
Boardwalk & Board Parking	1,500	SQFT	$20	$30,000
Site Electrical	1	LS	$30,000	$30,000
Access Ramp	1	LS	$20,000	$20,000
Stick-Built Washeteria	4,500	SQFT	$450	$2,025,000
New Foundation	1	LS	$100,000	$100,000
Washeteria Interior Remodel	0	LS	$200,000	$0
Washeteria Exterior Remodel	0	LS	$100,000	$0
Washeteria Equipment	1	LS	$50,000	$50,000
WTP- Equipment	1	LS	$200,000	$200,000
WTP-Piping & Valve Replacement	0	LS	$30,000	$0
WTP-HVAC	1	LS	$20,000	$20,000
Power Plant Waste Heat	1	LS	$513,000	$513,000
Emergency Generator	1	LS	$12,000	$12,000
Day Tank	1	LS	$8,000	$8,000
Tank Foundation-Gravel	600	CYD	$100	$60,000
Tank Foundation-Thermal Syphons	1	LS	$45,000	$45,000
New Water Storage Tank	1	LS	$300,000	$300,000
Yard Piping	1	LS	$10,000	$10,000
New Outfall Piping	260	FT	$400	$104,000
New Raw Water Piping	175	FT	$200	$35,000
Water Haul Trailer	1	LS	$20,000	$20,000
Commissioning	1	LS	$10,000	$10,000
O&M Manual & Training	1	LS	$10,000	$10,000
O&M Equipment	1	LS	$2,500	$2,500
			Subtotal	$4,614,500
Resident Project Representative	3%	of	$4,614,500	$138,435
Construction Administration	6%	of	$4,614,500	$276,870
Project Administration	6%	%	$4,614,500	$276,870
			Subtotal	$692,175
Total	$5,306,675			

Non-Construction Costs				
Item	No.	Unit	Cost	Total
Survey	1	LS	$20,000	$20,000
Geotechnical	1	LS	$60,000	$60,000
Land Acquisition/ROW	1	LS	$5,000	$5,000
Engineering	10%	of	$4,614,500	$461,450
Permitting	1	LS	$15,000	$15,000
Project Contingency	20%	of	$4,614,500	$922,900
Total	$1,484,350			

Operations & Maintenance Costs (Annual)				
Item	No.	Unit	Cost	Total
WTP Personnel	1000	HR	$30	$30,000
Washeteria Personnel	3,120	HR	$15	$46,800
Water Haul Personnel	676	HR	$30	$20,280
Administrative Costs	1	LS	$8,000	$8,000
Disposable Materials	1	LS	$5,000	$5,000
Workman's Comp	47.96	100 HR	$3	$132
Insurance (bldg, general)	1	LS	$2,000	$2,000
Heating Costs (oil fuel)	1	LS	$15,000	$15,000
Energy Costs (electric)	1	LS	$4,000	$4,000
Total	$131,212			

Item	Cost
Construction (Capital) Costs	$5,306,675
Non-Construction Costs	$1,484,350
Total Costs	$6,791,025
O&M Costs (Annual)	$131,212

Construction (Capital) Costs				
Item	No.	Unit	Cost	Total
Mob & Demo	1	LS	$1,000,000	$1,000,000
Construction Survey	1	LS	$5,000	$5,000
Boardwalk & Board Parking	1,500	SQFT	$20	$30,000
Site Electrical	1	LS	$30,000	$30,000
Access Ramp	1	LS	$20,000	$20,000
Modular Washeteria	4,500	SQFT	$600	$2,700,000
New Foundation	1	LS	$100,000	$100,000
Washeteria Interior Remodel	0	LS	$200,000	$0
Washeteria Exterior Remodel	0	LS	$100,000	$0
Washeteria Equipment	1	LS	$50,000	$50,000
WTP- Equipment	1	LS	$200,000	$200,000
WTP-Piping & Valve Replacement	0	LS	$30,000	$0
WTP-HVAC	1	LS	$20,000	$20,000
Power Plant Waste Heat	1	LS	$513,000	$513,000
Emergency Generator	1	LS	$12,000	$12,000
Day Tank	1	LS	$8,000	$8,000
Tank Foundation-Gravel	600	CYD	$100	$60,000
Tank Foundation-Thermal Syphons	1	LS	$45,000	$45,000
New Water Storage Tank	1	LS	$300,000	$300,000
Yard Piping	1	LS	$10,000	$10,000
New Outfall Piping	260	FT	$400	$104,000
New Raw Water Piping	175	FT	$200	$35,000
Water Haul Trailer	1	LS	$20,000	$20,000
Commissioning	1	LS	$10,000	$10,000
O&M Manual & Training	1	LS	$10,000	$10,000
O&M Equipment	1	LS	$2,500	$2,500
			Subtotal	$5,284,500
Resident Project Representative	4%	of	$5,284,500	$211,380
Construction Administration	6%	of	$5,284,500	$317,070
Project Administration	6%	%	$5,284,500	$317,070
			Subtotal	$845,520
Total	$6,130,020			

Non-Construction Costs				
Item	No.	Unit	Cost	Total
Survey	1	LS	$20,000	$20,000
Geotechnical	1	LS	$60,000	$60,000
Land Acquisition/ROW	1	LS	$5,000	$5,000
Engineering	10%	of	$5,284,500	$528,450
Permitting	1	LS	$15,000	$15,000
Project Contingency	20%	of	$5,284,500	$1,056,900
Total	$1,685,350			

Operations & Maintenance Costs (Annual)				
Item	No.	Unit	Cost	Total
WTP Personnel	1000	HR	$30	$30,000
Washeteria Personnel	3,120	HR	$15	$46,800
Water Haul Personnel	676	HR	$30	$20,280
Administrative Costs	1	LS	$8,000	$8,000
Disposable Materials	1	LS	$5,000	$5,000
Workman's Comp	47.96	100 HR	$3	$132
Insurance (bldg, general)	1	LS	$2,000	$2,000
Heating Costs (oil fuel)	1	LS	$15,000	$15,000
Energy Costs (electric)	1	LS	$4,000	$4,000
Total	$131,212			

Item	Cost
Construction (Capital) Costs	$6,130,020
Non-Construction Costs	$1,685,350
Total Costs	$7,815,370
O&M Costs (Annual)	$131,212

Life Cycle Costs & Short Term Assets List

Alternative 1: Remodel and Expand Existing Water Treatment Plant & Washeteria 3/12/2019

Year of Repair Replacement	Item/Event[1]	2018 Federal Discount Rate Conversion Factor[3]	Cost of Event in Todays Dollars	Present Value
1	Annual O&M Costs[4]	19.5861	$183,226	$3,588,674
1		0.9980		$0
2		0.9960		$0
3		0.9940		$0
4		0.9920		$0
5	Sealants	0.9901	$500	$495
6		0.9881		$0
7		0.9861		$0
8	Washers/Dryers	0.9841	$12,000	$11,810
9		0.9822		$0
10	Sealants, Exhaust Fans, Painting, Showers, Flooring	0.9802	$28,700	$28,132
11		0.9783		$0
12		0.9763		$0
13		0.9744		$0
14		0.9724		$0
15	Sealants/Water Haul Trailer and Tank	0.9705	$20,500	$19,895
16	Washers/Dryers	0.9685	$12,000	$11,622
17		0.9666		$0
18		0.9647		$0
19		0.9627		$0
20	Sealants, Exhaust Fans, Painting, Showers, Flooring	0.9608	$28,700	$27,576
20	Project Salvage Value[5]	-0.9608	$0	$0
			Total Present Value	**$3,688,204**

Total Construction Cost[7]	**$3,322,500**	Useful Life	20	yr
Annual O&M Costs	**$183,226**	Remaining Life	0	yr
Federal Discount Interest Rate[2]	0.2%			

Project Present Worth (Lift Cycle Cost)[6] $7,010,704

Notes:

1. See Short Term Assets list for items.
2. The Federal real discount interest rate from OMB Circular A94 for 2018. https://www.whitehouse.gov/wp-content/uploads/2017/11/Appendix-C-revised.pdf (retrieved 4/3/2018)
3. Short Lived Asset's discount in rate conversion factor is calculated by $1/(1+i)^n$
4. Annual O&M costs rate determined by uniform present value formula. $[(1+i)^n-1)/i(1+i)^n]$
5. Project salvage value = total construction cost x (remaining life/useful life) x (-1 x discount rate).
6. Project present worth = total construction cost + total present value
7. For Life Cycle Cost, total construction cost doesn't Resident Project Representatiave, CA Service, or Project Adminstration.

SHORT LIVED ASSETS LISTING & REPLACEMENT COST

Item/Event	Frequency (yr)	Amount	Unit	Cost	Total
Sealants and Chalking	5	1	LS	$500	$500
Washing Machines and Dryers	8	1	LS	$12,000	$12,000
Exhaust Fans	10	6	LS	$200	$1,200
Exterior and Interior Painting	10	1	LS	$8,000	$8,000
Showers	10	3	EA	$3,000	$9,000
Water haul trailer and Tank	15	1	EA	$20,000	$20,000
Flooring	10	2,000	SQFT	$5	$10,000

Life Cycle Costs & Short Term Assets List
Alternative 2: New Water Treatment Plant & Washeteria 3/12/2019

Year of Repair Replacement	Item/Event[1]	2018 Federal Discount Rate Conversion Factor[3]	Cost of Event in Todays Dollars	Present Value
1	Annual O&M Costs[4]	19.5861	$131,212	$2,569,928
1		0.9980		$0
2		0.9960		$0
3		0.9940		$0
4		0.9920		$0
5	Sealants	0.9901	$500	$495
6		0.9881		$0
7		0.9861		$0
8	Washers/Dryers	0.9841	$30,000	$29,524
9		0.9822		$0
10	Sealants, Exhaust Fans, Painting, Showers, Flooring	0.9802	$28,700	$28,132
11		0.9783		$0
12		0.9763		$0
13		0.9744		$0
14		0.9724		$0
15	Sealants/Water Haul Trailer and Tank	0.9705	$20,500	$19,895
16	Washers/Dryers	0.9685	$30,000	$29,056
17		0.9666		$0
18		0.9647		$0
19		0.9627		$0
20	Sealants, Exhaust Fans, Painting, Showers, Flooring	0.9608	$28,700	$27,576
20	Project Salvage Value[5]	-0.9608	$1,538,167	-$1,477,913
			Total Present Value	**$1,226,693**

Total Construction Cost[7]	**$4,614,500**	Useful Life	30	yr
Annual O&M Costs	**$131,212**	Remaining Life	10	yr
Federal Discount Interest Rate[2]	0.2%			

Project Present Worth (Lift Cycle Cost)[6] $5,841,193

Notes:
1. See Short Term Assets list for items.
2. The Federal real discount interest rate from OMB Circular A94 for 2018. https://www.whitehouse.gov/wp-content/uploads/2017/11/Appendix-C-revised.pdf (retrieved 4/3/2018)
3. Short Lived Asset's discount in rate conversion factor is calculated by $1/(1+i)^n$
4. Annual O&M costs rate determined by uniform present value formula. $[(1+i)^n-1)/i(1+i)^n]$
5. Project salvage value = total construction cost x (remaining life/useful life) x (-1 x discount rate).
6. Project present worth = total construction cost + total present value
7. For Life Cycle Cost, total construction cost doesn't Resident Project Representatiave, CA Service, or Project Adminstration.

SHORT LIVED ASSETS LISTING & REPLACEMENT COST

Item/Event	Frequency (yr)	Amount	Unit	Cost	Total
Sealants and Chalking	5	1	LS	$500	$500
Washing Machines and Dryers	8	1	LS	$12,000	$12,000
Exhaust Fans	10	6	LS	$200	$1,200
Exterior and Interior Painting	10	1	LS	$8,000	$8,000
Showers	10	3	EA	$3,000	$9,000
Water haul trailer and Tank	15	1	EA	$20,000	$20,000
Flooring	10	2,000	SQFT	$5	$10,000

Life Cycle Costs & Short Term Assets List
Alternative 3: New Modular Water Treatment Plant & Washeteria 3/12/2019

Year of Repair Replacement	Item/Event[1]	2018 Federal Discount Rate Conversion Factor[3]	Cost of Event in Todays Dollars	Present Value
1	Annual O&M Costs[4]	19.5861	$131,212	$2,569,928
1		0.9980		$0
2		0.9960		$0
3		0.9940		$0
4		0.9920		$0
5	Sealants	0.9901	$500	$495
6		0.9881		$0
7		0.9861		$0
8	Washers/Dryers	0.9841	$12,000	$11,810
9		0.9822		$0
10	Sealants, Exhaust Fans, Painting, Showers, Flooring	0.9802	$28,700	$28,132
11		0.9783		$0
12		0.9763		$0
13		0.9744		$0
14		0.9724		$0
15	Sealants/Water Haul Trailer and Tank	0.9705	$20,500	$19,895
16	Washers/Dryers	0.9685	$12,000	$11,622
17		0.9666		$0
18		0.9647		$0
19		0.9627		$0
20	Sealants, Exhaust Fans, Painting, Showers, Flooring	0.9608	$28,700	$27,576
20	Project Salvage Value[5]	-0.9608	$1,761,500	-$1,692,498
			Total Present Value	**$976,960**

Total Construction Cost[7]	**$5,284,500**	Useful Life	30	yr
Annual O&M Costs	**$131,212**	Remaining Life	10	yr
Federal Discount Interest Rate[2]	0.2%			

Project Present Worth (Lift Cycle Cost)[6] $6,261,460

Notes:
1. See Short Term Assets list for items.
2. The Federal real discount interest rate from OMB Circular A94 for 2018. https://www.whitehouse.gov/wp-content/uploads/2017/11/Appendix-C-revised.pdf (retrieved 4/3/2018)
3. Short Lived Asset's discount in rate conversion factor is calculated by $1/(1+i)^n$
4. Annual O&M costs rate determined by uniform present value formula. $[(1+i)^n-1)/i(1+i)^n]$
5. Project salvage value = total construction cost x (remaining life/useful life) x (-1 x discount rate).
6. Project present worth = total construction cost + total present value
7. For Life Cycle Cost, total construction cost doesn't Resident Project Representatiave, CA Service, or Project Adminstration.

SHORT LIVED ASSETS LISTING & REPLACEMENT COST

Item/Event	Frequency (yr)	Amount	Unit	Cost	Total
Sealants and Chalking	5	1	LS	$500	$500
Washing Machines and Dryers	8	1	LS	$12,000	$12,000
Exhaust Fans	10	6	LS	$200	$1,200
Exterior and Interior Painting	10	1	LS	$8,000	$8,000
Showers	10	3	EA	$3,000	$9,000
Water haul trailer and Tank	15	1	EA	$20,000	$20,000
Flooring	15	2,000	SQFT	$5	$10,000

Tuntutuliak Water Treatment Plant/Washeteria PER
Cost Summary

3/12/2019

Costs	Alt 1-Remodel	Alt 2-New WTP/Washet	Alt 3-New Modular
Construction (Capital) Costs	$4,386,000	$5,307,000	$6,131,000
Non-Construction Costs	$1,220,000	$1,485,000	$1,686,000
Total Project Costs	$5,606,000	$6,792,000	$7,816,000
O&M Costs (Annual)	$184,000	$132,000	$132,000
Life Cycle Costs	$7,011,000	$5,842,000	$6,262,000

a. Total Project Cost Estimate (Engineer's Opinion of Proposed Project Costs)

The following tables summarize the construction and non-construction costs for the proposed project.

Table 6.1: Proposed Project-New Modular WTP & Washeteria Construction (capital) Costs

Water System-WTP Upgrades/Washeteria		
Description	Code	Total Cost
Washeteria-Water System Total	C-WA	$2,272,750
Boardwalk & Board Parking	M-BW	$15,000
Water Treatment Upgrades Total	W-WP	$220,000
Water Tank Gravel Pad	F-GR	$60,000
Water Tank Thermal Syphons	F-FT	$45,000
Water Tank	W-WT	$300,000
Water-Other Items Total	W-WO	$30,000
Raw Water Piping	W-SL	$35,000
Permitting	M-DS	$7,500
Subtotal Cost		$2,985,250
Contingencies (20%)		$597,050
Total Construction Cost		$3,582,300
Project Technical Support (8%)		$286,584
Specialty Engineering		$418,531
Total Costs: Water System-WTP/Washeteria		$4,287,415

Sewer Systems-Washeteria		
Description	Code	Total Cost
Washeteria-Sewer System Total	C-WA	$2,272,750
Boardwalk & Board Parking	M-BW	$15,000
New Outfall Piping	S-SF	$104,000
Permitting	M-DS	$7,500
Subtotal Cost		$2,399,250
Contingencies (20%)		$479,850
Total Construction Cost		$2,879,100
Project Technical Support (8%)		$230,328
Specialty Engineering		$418,531
Total Costs: Sewer System-Washeteria		$3,527,959
Project Summary Costs		$7,815,373

Tuntutuliak Water Treatment Plant/Washeteria Improvements
Tuntutuliak, Alaska
SDS Cost Estimate

Prepared by Daniel Nichols, Kuna (03/20/2019)

	Description	Code	Unit	Quantity	Unit Cost	Total Cost
Water System-WTP Upgrades/Washeteria						
1	Geotechnical Investigation-Site Foundation	C-WA	Ea	0.5	$60,000	$30,000
2	Site Survey	C-WA	Ea	0.5	$20,000	$10,000
3	ROW/Title Searches	C-WA	Ea	0.5	$5,000	$2,500
4	Mob & Demo	C-WA	Ea	0.5	$1,000,000	$500,000
5	Construction Survey	C-WA	Ea	0.5	$5,000	$2,500
6	Boardwalk & Board Parking	M-BW	Sf	750	$20	$15,000
7	Site Electrical	C-WA	Ea	0.5	$30,000	$15,000
8	Access Ramp	C-WA	Ea	0.5	$20,000	$10,000
9	Modular Washeteria	C-WA	Sf	2,250	$600	$1,350,000
10	New Foundation	C-WA	Ea	0.5	$100,000	$50,000
11	Washeteria Equipment	C-WA	Ea	0.5	$50,000	$25,000
12	WTP- Equipment	W-WP	Ea	1	$200,000	$200,000
13	WTP-HVAC	W-WP	Ea	1	$20,000	$20,000
14	Power Plant Waste Heat	C-WA	Ea	0.5	$513,000	$256,500
15	Emergency Generator	C-WA	Ea	0.5	$12,000	$6,000
16	Day Tank	C-WA	Ea	0.5	$8,000	$4,000
17	Tank Foundation-Gravel	F-GR	CYD	600.0	$100	$60,000
18	Tank Foundation-Thermal Syphons	F-FT	Ea	1	$45,000	$45,000
19	New Water Storage Tank	W-WT	Ea	1	$300,000	$300,000
20	Yard Piping	W-WO	Ea	1	$10,000	$10,000
21	New Raw Water Piping	W-SL	Ft	175	$200	$35,000
22	Water Haul Trailer	W-WO	Ea	1	$20,000	$20,000
23	Permitting	M-DS	Ea	0.5	$15,000	$7,500
24	Commissioning	C-WA	Ea	0.5	$10,000	$5,000
25	O&M Manual & Training	C-WA	Ea	0.5	$10,000	$5,000
26	O&M Equipment	C-WA	Ea	0.5	$2,500	$1,250

Construction Cost		$2,985,250
Contingencies	20%	$597,050
Total Construction Cost		$3,582,300
Project Technical Support	8%	$286,584
Specialty Engineering (Specify[1])		$418,531
Subtotal Costs: Water System-WTP/Washeteria		**$4,287,415**

	Description	Code	Unit	Quantity	Unit Cost	Total Cost
Sewer Systems-Washeteria						
1	Geotechnical Investigation-Site Foundation	C-WA	Ea	0.5	$60,000	$30,000
2	Site Survey	C-WA	Ea	0.5	$20,000	$10,000
3	ROW/Title Searches	C-WA	Ea	0.5	$5,000	$2,500
4	Mob & Demo	C-WA	Ea	0.5	$1,000,000	$500,000
5	Construction Survey	C-WA	Ea	0.5	$5,000	$2,500
6	Boardwalk & Board Parking	M-BW	Sf	750	$20	$15,000
7	Site Electrical	C-WA	Ea	0.5	$30,000	$15,000
8	Access Ramp	C-WA	Ea	0.5	$20,000	$10,000
9	Modular Washeteria	C-WA	Sf	2,250	$600	$1,350,000
10	New Foundation	C-WA	Ea	0.5	$100,000	$50,000
11	Washeteria Equipment	C-WA	Ea	0.5	$50,000	$25,000
12	Power Plant Waste Heat	C-WA	Ea	0.5	$513,000	$256,500
13	Emergency Generator	C-WA	Ea	0.5	$12,000	$6,000
14	Day Tank	C-WA	Ea	0.5	$8,000	$4,000
15	New Outfall Piping	S-SF	Ft	260	$400	$104,000
16	Permitting	M-DS	Ea	0.5	$15,000	$7,500
17	Commissioning	C-WA	Ea	0.5	$10,000	$5,000
18	O&M Manual & Training	C-WA	Ea	0.5	$10,000	$5,000
19	O&M Equipment	C-WA	Ea	$1	$2,500	$1,250

Construction Cost		$2,399,250
Contingencies	20%	$479,850
Total Construction Cost		$2,879,100
Project Technical Support	8%	$230,328
Specialty Engineering (Specify[1])		$418,531
Subtotal Costs: Sewer System-Washeteria		**$3,527,959**

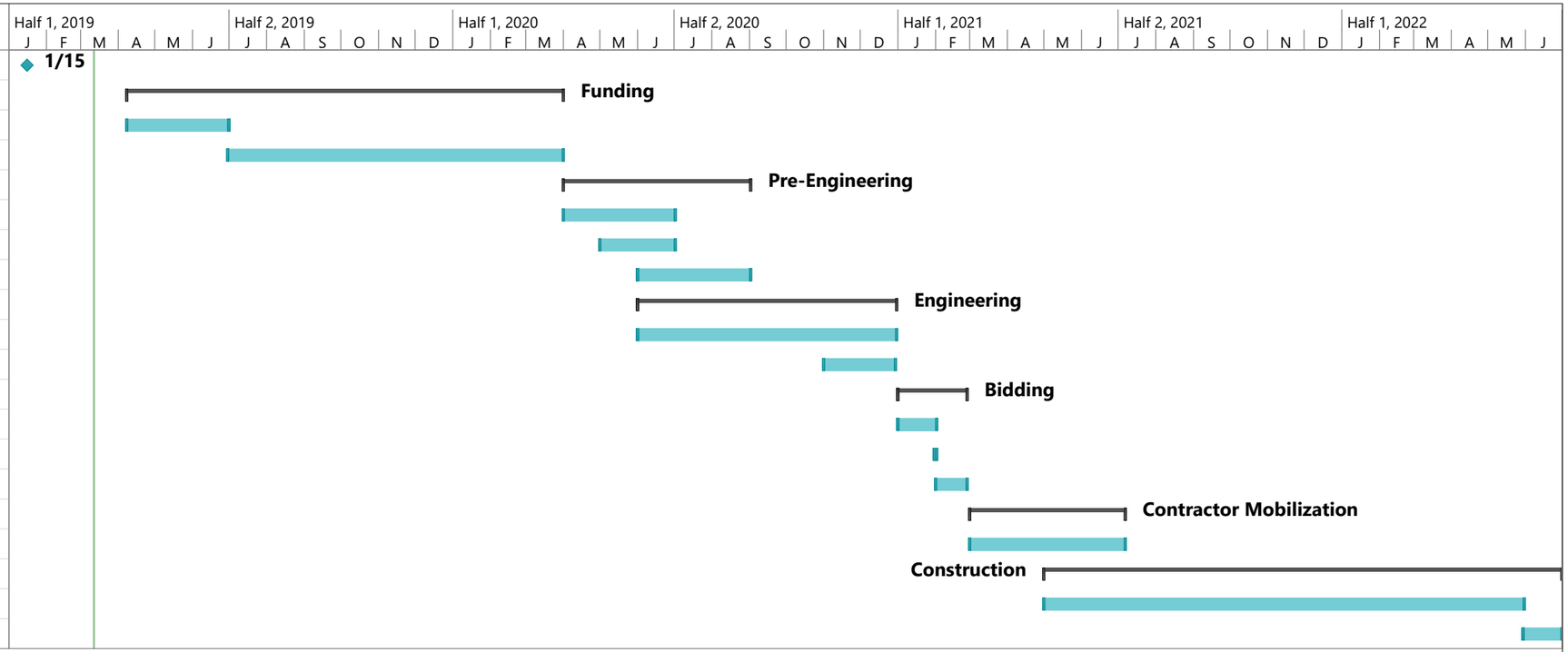
Project Summary	
Water System-WTP Upgrades/Washeteria	$ 4,287,415
Sewer Systems-Washeteria	$ 3,527,959
Total =	**$ 7,815,373**

1. Specialty Engineering justification: Architectural, structural, civil, electrical, mechanical and system integration design service will be required to complete the design and construction of the project.

Appendix E: Proposed Project Scheduled

95% DRAFT REPORT

ID	Task Mode	Task Name	Duration	Start
1		PER & ER	1 day	Tue 1/15/19
2		**Funding**	**257 days**	**Mon 4/8/19**
3		Request Funding	61 days	Mon 4/8/19
4		Secure Funding	198 days	Sun 6/30/19
5		**Pre-Engineering**	**110 days**	**Wed 4/1/20**
6		Geotechnical Investigation	66 days	Wed 4/1/20
7		Survey	44 days	Fri 5/1/20
8		ROW Aquisiction	67 days	Mon 6/1/20
9		**Engineering**	**153 days**	**Mon 6/1/20**
10		Construction Documents	153 days	Mon 6/1/20
11		Permitting	43 days	Sun 11/1/20
12		**Bidding**	**41 days**	**Fri 1/1/21**
13		Bid Advertising	22 days	Fri 1/1/21
14		Contractor Selection	2 days	Sun 1/31/21
15		Contracting	20 days	Mon 2/1/21
16		**Contractor Mobilization**	**92 days**	**Mon 3/1/21**
17		Mobilization	92 days	Mon 3/1/21
18		**Construction**	**304 days**	**Sat 5/1/21**
19		Construction	282 days	Sat 5/1/21
20		Contract Closeout	24 days	Mon 5/30/22



Project: Tuntutuliak
New WTP & Washeteria
Date: Tue 3/12/19

Task	Project Summary	Manual Task	Start-only	Deadline
Split	Inactive Task	Duration-only	Finish-only	Progress
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks	Manual Progress
Summary	Inactive Summary	Manual Summary	External Milestone

Appendix F: Approvals

Contents:

- VSW Lead Engineer's Approval of PER
- VSW Approval of Alternative
- Tuntutuliak Tribal Council Resolution

THE STATE of ALASKA
GOVERNOR MIKE DUNLEAVY

Department of Environmental Conservation

DIVISION OF WATER
Village Safe Water

555 Cordova Street
Anchorage, Alaska 99501
Main: 907.269.7502
Fax: 907.269.7509
dec.alaska.gov

DATE: March 21, 2019

FROM: Doug Poage, P.E., Village Safe Water Program (VSW)

TO: Susan Randlett, P.E., VSW

SUBJECT: Lead Engineer's **Review of Preliminary Engineering Report**

The 95% "Tuntutuliak Water Treatment/Washeteria Preliminary Engineering Report (PER)" dated March 20, 2019 was submitted by Susan Randlett to the VSW Lead Engineer for review.

This PER is approved for submission to the Full Committee that reviews PERs at the 95% level of completion.

It remains for the community to pass a resolution adopting the PER, which should complete the PER work.

Sincerely,

Doug Poage, P.E.
Lead Engineer
Village Safe Water

THE STATE of ALASKA
GOVERNOR MIKE DUNLEAVY

Department of Environmental Conservation

DIVISION OF WATER
Village Safe Water

555 Cordova Street
Anchorage, Alaska 99501
Main: 907.269.7502
Fax: 907.269.7509
dec.alaska.gov

April 16, 2019

Susan Randlett, P.E.
Alaska Department of Environmental Conservation
Village Safe Water Program
555 Cordova Street
Anchorage, Alaska 99501

Dear Ms. Randlett:

We have reviewed the "Tuntutuliak Water Treatment Plant/Washeteria Preliminary Engineering Report (PER)" dated March 2019, prepared by Kuna Engineering for use in project 18RQ58.

This PER evaluates alternatives to address deficiencies with Tuntutuliak's existing Water Treatment Plant and Washeteria.

This PER recommends Alternative 3: New Modular Water Treatment Plant and Washeteria, which includes:

- Installing a new 4,500 SF modular water plant and washeteria with a pile foundation to replace the current facility constructed in 1980. A watering point will be included.
- Installing a 100,000 gallon water storage tank.
- Installing a waste heat recovery system to provide heat from the community-owned power plant.
- Replacing the sewage outfall discharging to the graywater tundra pond.
- Continuing to use the existing well.
- Addressing arsenic contamination.

The estimated capital cost for this alternative is $7,815,374.

This PER is approved for VSW reviewing purposes. However, Tuntutuliak is not currently eligible to apply for Capital Improvement Project (CIP) funding because Tuntutuliak's Spring 2019 Best Practices score is 23. A minimum score of 35 is required to apply for CIP funding. Please consider working to increase the current Best Practices score and applying for CIP funding next year.

The Department of Environmental Conservation reserves the right to rescind this approval if costs increase beyond those included in the report.

If you have any questions or would like to discuss this review in more detail, please let me know.

Sincerely,

Marlena Brewer
VSW Program Manager